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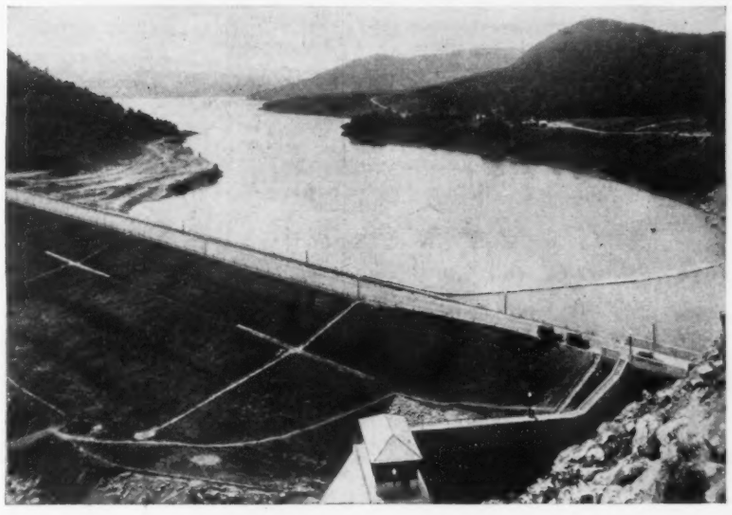

Sacandaga development New York Power & Light Corporation

Ewing Galloway

MARCH 28, 1931

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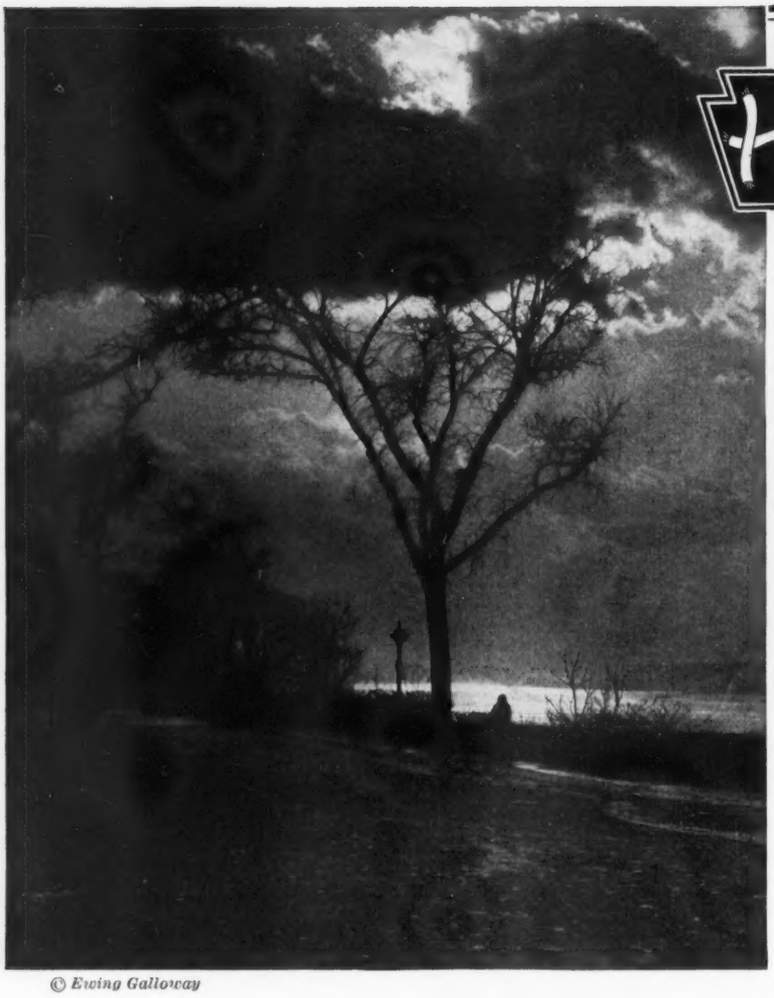

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ELECTRICAL WORLD

for the Week Ending

March 28, 1931

Arkwright seeks to raise Crisp County rates

With the growth of railroad electrification the necessity will arise for the interchange of equipment among railroads, and unless a system of power distribution can be agreed upon as a standard, the diversity of electrical characteristics among railroads is going to be a major calamity.

SIDNEY WITHINGTON,

Electrical Engineer
New York, New Haven & Hartford Railroad.

—**Alabama Power Company** probe analyzed on basis of history and accomplishments as developed in Federal Trade Commission hearing. Financial and corporate activities tell rapid rise of this organization—*p. 601.*

—**Executives respond to plan** offered by McGraw-Hill for stabilization of business. More than 800 busy men have given constructive suggestions and frank opinions of platform—*p. 584.*

Pinchot has new regulatory idea

—**Half over 7 per cent return** would go to the state according to most recent plan of Pennsylvania's Governor for reform of utilities commission and subjugation of power industry—*p. 566.*

—**Sources for new-era lighting** must be developed without undue sacrifice of lamp life or efficiency. Perhaps modern-idea enthusiasts will need to temper their notions to source characteristics—*p. 595.*

Alabama Power hearings analyzed

—**Seattle Council defies Mayor.** Will have none of his nominee offered for approval to replace J. D. Ross as engineer of city's lighting department. Impasse develops—*p. 567.*

—**Hydro practices differ abroad,** discovers one of America's more prominent engineers, who has made notes of refreshing variations which are favored overseas. Reasoning analyzed—*p. 588*

New River case plagues Power Board

—Power group interrelations as reflected in financial and corporate ties have been charted to show the status of the more important American companies as of recent date—*p. 610.*

—**Electrode-type water heater** operating on off-peak rates offers a new factor of substantial economies in commercial and residential use. Hot water or steam obtainable—*p. 576.*

Pinchot's Bill for New Commission Has Revolutionary Feature

CONTAINING one of the most revolutionary provisions embodied in any regulatory bill proposed with executive backing in any state in recent years, Governor Pinchot's proposal for the abolition of the Public Service Commission and the creation of a Fair Rate Board was introduced last Monday in the Pennsylvania Legislature. The clause referred to, which is expected to arouse strenuous opposition from utility companies and security holders, provides that all earnings in excess of 8 per cent shall be turned over to the state treasury. Earnings in excess of 7 per cent but not exceeding 8 per cent would be divided equally between the state and the utility company.

Other features of the measure include full authority by the new board to disapprove utility security issues which do not represent actual investment and permission for cities, boroughs and districts either to build their own municipal plants or seize existing ones by condemnation if rates are proved unfair. The bill would make approval by the board a prerequisite to rate changes and would also make the state the inspector of meters with power to impose penalties upon the utilities if meters proved incorrect. Discarding the conception of the commission as a court, it makes the board the public defender and does not provide for a people's counsel as had been previously suggested by friends of the administration.

The board would comprise representatives elected from each of seven districts, and members would serve for seven years after the first "staggering" of terms according to precedent. The chairman would be paid an annual salary of $10,500 and the other members $10,000.

Governor Pinchot said that the measure aims to reduce the spread between the rates paid by small and those paid by large consumers. Another purpose, he added, is to prevent inflation of stock by holding companies.

▼

"All Set" for St. Lawrence Scheme, Says Senator

WARREN T. THAYER, chairman of the New York State Senate's committee on public service, said on Wednesday to a representative of the ELECTRICAL WORLD that the Legislature would pass the Cornaire St. Lawrence water-power bill, with possibly some slight amendments; that the bill would probably not be introduced in the Senate, and that he did not think a public hearing would be held thereon. He said it was not the disposition of the Senate to accept the recommendation of the Governor for the appointment of three commissioners at $20,000 a year salary in lieu of the part-time members of the Power Authority provided in the bill, to work on a per-diem allowance, total remuneration not to exceed $10,000 a year.

Senator Thayer said that the bill passed by the Legislature this year would enable the State of New York officially to start negotiations and that amendments could be made next year as practical experience of the Power Authority might determine.

The Senator is convinced in his own mind that the United States government will eventually build the dam and allow the State of New York or some other agency to make the actual development of the hydro-electric power. He asserted that negotiations have been under way between the United States government officials and Canada for some weeks now and that an announcement from President Hoover after his return from his vacation is due.

In addition to the recommendation noted above, Governor Roosevelt in a letter to the legislative leaders of both houses refers to what he regards as a serious omission in the pending measure, the lack of provision prohibiting the sale or lease of dam or power house or transmission line built by the proposed State Power Authority, and urged that this defect be corrected. He also requests some other amendments of a less important character.

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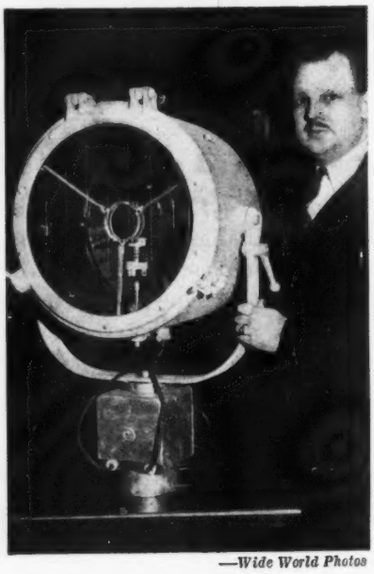
130-MILE RAYS FROM 250-WATT BULB



—*Wide World Photos*

The feature of this lamp, as explained by W. A. Pennow, airport engineer for Westinghouse, is that the light source is an ordinary 250-watt lamp with a concentrated filament. One of these lights installed at Columbus was reported visible by pilots over Toledo.

▼

Georgia Power Would Raise Rates in Crisp County

AN END TO THE rate strife in Crisp County, Ga., which has attracted nation-wide attention, may come through the voluntary action of the Georgia Power Company. Appearing before the Georgia Public Service Commission on Wednesday, its president, Preston S. Arkwright, asked permission to raise rates in the area affected 35 per cent, or to the level of the county charge.

Mr. Arkwright testified that before the county plant was in operation the power company had 1,100 customers in the area, with gross annual revenue of $81,000, while today the company has only 125 customers, with an annual gross revenue of $5,691. He added that the company pays the county and the city of Cordele, near which the county plant was built, $6,316 a year in taxes.

As recounted in previous issues of the ELECTRICAL WORLD, the Crisp County plant started operation with a 25 per cent reduction below the company rates, and the company in turn cut its rate to 35 per cent below the county rate. The Public Service Commission then issued an order asking the power company to show cause why this rate should not prevail throughout the state, and after a struggle in the courts its right to hold a hearing on this point was sustained.

▼

Seattle Council Rejects Mayor's New Nominee

REAFFIRMING ITS DETERMINATION to approve no nomination for superintendent of the city lighting department except one of former Superintendent J. D. Ross, the Seattle City Council on March 23 rejected Major W. Chester Morse, Mayor Edwards' second nominee. The Mayor is expected to submit the name of Armand F. Marion, his original choice, next week, alternating the two names at ten-day intervals.

ANOTHER FIFTEEN-MILE FALLS POWER PLANT GOES ON THE LINE

The first generating unit of the 10,000-kw. hydro-electric plant of the Grafton Power Company, a part of the New England Power Association, at McIndoes Falls, near East Barnet, Vt., on the Connecticut River, went in service March 14. This, the second plant of the Fifteen-Mile Falls group, operates on 27-ft. head.

▼ ▼ ▼

Mayor Edwards filed fifteen charges against Mr. Ross, going back twenty years for his material, and Ross branded each charge as false, being backed up by several councilmen who said that the charges were "old stuff." The Council is expected to invite the Mayor to appear and substantiate his accusations.

▼

New York Bills Again Opposed by Utilities

THE SERIES OF NINE BILLS backed by Governor Roosevelt of New York and intended to bring stricter regulation of public utility companies were assailed on Wednesday at a hearing before the Senate public service committee as an "insidious effort to achieve public ownership." The measures were supported, on the other hand, by several utility experts, and Milo R. Maltbie, chairman of the Public Service Commission, spoke in behalf of some of them. They embrace the Democratic program for utility regulation, fix valuation on the "prudent investment" theory and provide for contracts with a permanent rate basis on a "fair return."

Charles T. Russell, general counsel for the New York Telephone Company, led the assault on the measures, charging that they were "political propaganda." Randall J. Le Boeuf, representing the Niagara-Hudson corporation, presented a similar argument, as did William L. Ransom, representing the Consolidated Gas Company, and Henry Killeen of Buffalo.

Dr. John Bauer held that the measures were designed merely to make regulation more effectve. He maintained that investment in utility stocks would not be adversely affected. Leland Olds of the Community Council of Greater New York asserted that the bills would bring lower rates and ridiculed the charge that they were "radical."

Chairman Maltbie supported those bills providing that intercompany charges shall not exceed the cost of the service rendered, giving to the Public Service Commission the right to require public bidding on securities of utility companies and giving municipalities the right to become parties to proceedings involving rates.

▼

New England Division Elects New Officers

OFFICERS FOR THE New England Division of the National Electric Light Association were elected at Boston a week ago, following a joint meeting of the Commercial and Public Relations Sections at which about 250 representatives of the industry were present. The new officers are: President, W. C. Bell, New England Power Company; vice-president, David Daly, Blackstone Valley Gas & Electric Company; second vice-president, W. A. Buttrick, Twin State Gas & Electric Company.

O. H. Caldwell, editor *Electronics* and formerly a member of the Federal Radio Commission, spoke concerning possibilities for development of thermionic and photo-cell devices in industry and electrical distribution and transmission. Commercial Director Greenwood of N.E.L.A. headquarters spoke on state laws designed to prevent merchandising by utility companies.

Sloan Hits Back at Attackers of Utilities

"ALL THIS IS POLITICS," declared Matthew S. Sloan, president of the New York Edison system, referring to attacks on the power industry, in the course of an address on "Public Utilities as Investments" he delivered on March 19 before bankers in Newark, N. J.

"You cannot read a paper or magazine, particularly a magazine of the class which sometimes refers to itself as a 'molder of thought,' without being told that regulation has broken down," he said. "When you turn on your radio, you are likely to hear some governor or senator denouncing the 'power trust' for its nefarious juggling of the law and plundering of the people. The halls of Congress and state legislatures echo the discussion. Public officials argue that the only way to curb the utilities and protect the public is by government ownership and operation of the electric business, wherever possible now and everywhere eventually. All this is politics. I was going to say politics pure and simple, but it is not entirely pure and certainly it is not simple."

Despite all the anti-utility activity, Mr. Sloan expressed his confidence that "most citizens have a tolerably accurate perspective on the situation." The basic position he summed up thus:

"The electric utilities are a key business, one on which depend the progress and welfare of our nation. I see for them a future as prosperous as their present, a future of ever-widening usefulness. For all the reasons I have outlined, they are, in my judgment, good investments now, and I am convinced they will not cease to be good investments."

New River Case Still Plagues Power Board

QUESTIONS INVOLVED in the New River case are still being actively discussed by the members of the Federal Power Commission. The Appalachian Electric Power Company, which desires a minor-part license to develop power on New River near Radford, Va., the State of Virginia and other states have, as already reported, objected strenuously to the assumption of complete jurisdiction by the commission.

The action of the United States Supreme Court in approving a decision by the Supreme Court of Wisconsin which held Four-Mile Creek to be a navigable stream is expected to have a bearing on the New River case. It is by no means certain, however, that this decision would apply to projects covered by the water-power act. That act defines navigability, but the definition is susceptible to more than one interpretation. For these and other reasons a final determination of the New River case is presenting unusual difficulties.

The commission has obtained data covering past traffic on the stream, which was once considerable.

▼

Commercial Section for Complete Electrification

INCLUSION OF MAJOR electrical appliances in the blueprints of contractors and speculative builders of dwellings as a matter of course, just as bathtubs or doors are included, is the ultimate goal of a domestic electrification plan that was presented to and received the enthusiastic approbation of the Commercial Section of the N.E.L.A. at its committee meetings in Chicago this week. An exposition of the actual working of the idea as it has been applied in Albany, N. Y., was given to the merchandise sales committee, and that committee set in motion the machinery necessary for the presentation of the idea on a national scale not only to utilities but to builders and contractors as well.

Another significant decision of the committee relates to the need for continuous sales pressure on all types of load-building equipment and for abandonment of the too common sales policy that puts accentuated effort on one or two equipments for a time and permits promotion of others to languish.

Other proceedings in various committees concerned the specification of the demands on wiring for the modern home that will prevail in five or ten years, rate schedules for domestic water heating, air conditioning, the operation of steam hammers by compressed air, service to hotels and office buildings by Diesel engines, and pipe-line pumping. The last-named subject was regarded as of special urgency.

The second national home service conference discussed methods for informing housewives concerning the manifold benefits of electricity to them.

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ODD LAMP STANDARD

By utilizing the trunk of a dead tree the Cincinnati zoo has installed two large lamps in a parking area where a metal standard would soon get smashed.

▼

No Constitutional Issue in Utility's Damage Suit

THE SUIT OF THE Philadelphia Electric Company against the city of Philadelphia for damages to compensate for the enforced removal of some of its conduits was dismissed by the United States Supreme Court recently for want of a substantial federal question. The company contended that its franchise permitted the maintenance of an electric conduit under Broad Street and that the subsequent action of the city authorities in requiring the removal of underground structures in connection with the building of a subway was unconstitutional. In the court of first instance judgment was rendered against the city. This was later reversed by the Pennsylvania Supreme Court, and the action of the United States Supreme Court in dismissing the case makes the decision final.

Power and Regulation in State Legislatures

ALABAMA.—Governor Miller has announced that he will present to the Legislature when it reconvenes on March 31 a proposal that a commission be named to confer with a similar commission from Tennessee, already appointed, and with representatives of the National Farm Bureau and the Engineer Corps of the army in an effort to solve the Muscle Shoals problem in accordance with the suggestion made by President Hoover in his message vetoing the Norris Muscle Shoals bill.

CONNECTICUT.—The Legislature has overridden Governor Cross' veto of a bill changing the method of removing from office members of the Public Utilities Commission. The bill would amend the present law so that it would no longer be possible for ouster proceedings to be brought against the commission on petition of 100 electors. This method was used by Albert Levitt in his action to remove the commissioners. (ELECTRICAL WORLD, July 19, 1930, page 99.) A bill to permit towns to tax power lines passing through them has been introduced. A Supreme Court decision held that lines were taxable only in the town where the generating station was situated. Senate bills to give the commission power to initiate proceedings against utilities, to require 20 days' notice of intention to alter rates and to give the commission supervision of security issues have been rejected.

ILLINOIS.—Two amendments to the public utilities act have been referred to committees of the House and Senate respectively. The House amendment is to the effect that no utility may discontinue service without a subscriber's consent unless authorized to do so by a municipal court or justice of the peace. The Senate amendment provides that in rate hearings comparisons with rates elsewhere may be made without showing similarity of conditions, the commission to determine the value of such evidence.

IDAHO.—The special session has passed a bill to levy a tax on 0.5 mill per kilowatt-hour on electrical energy generated in the State, and the Governor has signed it.

IOWA.—The House has unanimously concurred in seven amendments to the bill permitting municipalities to purchase public utilities plants from future earnings. The Governor is expected to sign the bill.

KANSAS. — The Legislature adjourned on March 17, and Governor Woodring has signed, with hearty approval, the bill appropriating $100,000 to enable the Public Service Commission to "get lower gas and electric

rates," the companion law giving the commission power to "probe into the books of holding companies . . . to prevent these companies from concealing excess profits," and the bill "divorcing retail merchandising from public utilities." The Governor expresses much disappointment that a bill to compel the utilities to pay the cost of the conduct of the commission was defeated, saying: "The intense fight made by the utilities against this proposal has reacted very unfavorably against utilities throughout the state and has intensified demands for further regulation and against monopolies in general."

MASSACHUSETTS. — Sheldon E. Wardwell, representing the Massachusetts Gas and Electric Association, appeared before a legislative committee March 17 to protest against the bills aimed to make it easier for municipalities to go into the electric light business. Mr. Wardwell was particularly bitter against the bill filed by the Public Franchise League under which the Department of Public Utilities would be empowered to fix a price at which private plants might be purchased, declaring it to be confiscatory and to change the commission into a court of last resort. The Department of Public Utilities is opposing another bill which would deprive it of jurisdiction over investment trusts and vest control in the state bank commissioner.

MISSOURI.—The Senate committee on private corporations, railroads and internal improvements has reported unfavorably two bills designed to give the Public Service Commission more power. One bill would have required all utilities to report annually the names of all persons and corporations holding more than 1 per cent of their voting stock, with the object of enabling the commission to go fully into relations of public utilities with affiliated companies. The second measure authorized the commission to inquire into all transactions between a public utility company and its holding corporation and other affiliated companies and in this connection gave it the right to disapprove contracts. There is thought to be small likelihood of the Senate overriding the reports.

NEBRASKA.—The Senate, after having first overridden an adverse committee report, finally killed the measure forbidding gas and electric companies from making service charges, largely on the ground that municipalities have full control of rates and can forbid such charges as they may decide. The Senate standing committee has approved a House bill permitting publicly owned utilities to invest their funds in securities issued by the state or its subdivisions. The Senate has approved a bill creating a fair trade commission. It is aimed at chain stores, but its author says it will serve also to regulate the competition that power companies have engaged in with hardware dealers over the sale of electrical merchandise.

NEVADA.—The bill sponsored by the Nevada Merchandising Association to prohibit public utilities from engaging in retail merchandising has been killed in the Senate.

OHIO.—On the ground that "the professional relationship is essentially a confidential relation to which an impersonal corporation cannot well be a party," Governor White has vetoed a bill intended to create a state board of registration for professional engineers and land surveyors and to require such men engaged on public works to be licensed. It provided that a firm or copartnership or a corporation might engage in the practice of engineering and surveying.

OKLAHOMA.—The Governor has signed the bill forbidding utilities to merchandise, and it is now law.

PENNSYLVANIA.—The rival investigations of the Public Service Commission conducted respectively by Senate and House committees still continue, and no report from either is expected before well on in April. Commissioners Young, Benn and Brown have appeared before the House committee, and hostile elements have deduced admissions of laxity from some of the testimony, Commissioner Young, for instance, admitting that the commission had not initiated proceedings as frequently as perhaps it should, which he blamed on insufficient funds and staff. Sixteen officials of the Philadelphia Electric and United Gas Improvement companies were subpoenaed. J. E. Zimmermann testified on Wednesday, and among those to follow were R. Z. Zimmermann, William H. Taylor, N. E. Funk, H. P. Liversidge and Edward Porter. Governor Pinchot's own bill to abolish the present commission and set up a new regulatory body has been sent to the Assembly. Its provisions are explained on page 566.

SOUTH CAROLINA.—By a vote of 43 to 40 the House defeated the hydroelectric power tax bill, which would have imposed a tax of 0.5 mill on each kilowatt-hour generated. A new bill exactly like it except that the tax is only 0.3 mill has been introduced, but no action had been taken on it as this was written.

SOUTH DAKOTA. — Governor Green has signed the bill to permit municipalities to pledge future earnings of municipal utility plants to secure operating capital.

TENNESSEE.—A House resolution demanding a thorough probe of the Railroad and Public Utilities Commission, concerning charges of exorbitant rates allowed power companies, failure to protect public interests in the sale of the Southern Cities Power Com-

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DALLAS POWER & LIGHT COMPANY'S 8,000-FT.-LONG DAM

The low earthen dam, 8,000 ft. long, part of which may be seen in the background, is being built by the Dallas company on Mountain Creek, a few miles west of the city limits, to create a reservoir for condensing water. It will be completed by September. Future plans include a 200,000-kw. generating plant at this site, the first unit to be about 30,000 kw. A driveway around the lake will be built by the company and recreational pursuits permitted.

pany to the Tennessee Electric Power Company and general negligence of the citizens' interests in fixing rates for public utilities, has been referred by the Senate to the legislative investigation committee already in existence.

TEXAS.—In a new House bill counties and cities are forbidden to give exclusive franchises to utilities, and it is made unlawful for one utility to own stock in another. Another new bill provides that no business manager of any incorporated city who is pecuniarily interested in a utility can take part in fixing rates. Dallas officials have protested against any legislation affecting that city's jurisdiction over utilities.

WASHINGTON.—A House bill introduced authorizes taxing the property of any public utility which erects structures other than transmission lines in another state which will depend on Washington water power.

WISCONSIN.—More than 4,000 residents in the sparsely populated northern region of the state have petitioned the Legislature opposing the district power bill and the bill which allows municipalities to compete with privately owned companies operating in the same territory.

▼

Egan Testifies Before Missouri Commission

LOUIS H. EGAN, president of the Union Electric Light & Power Company of St. Louis, in testifying before the Missouri Public Service Commission at Jefferson City on March 18 in the rate case affecting that company, declared himself in favor of electric light and power companies setting up a special replacement reserve of not less than 20 per cent of the value of their operating properties to meet any emergency that might arise as a result of changing conditions in the electrical business. He also expressed the view that the company should be permitted to earn on the total cost of its properties without deductions for depreciation.

Particularly opposing the city of St. Louis' attempt to force a reduction in rates for domestic consumers, Mr. Egan declared against any cut in rates at this time. "There are certain commercial rates which are in line for a reduction to secure better equalization among the classifications of consumers before domestic consumers can be given a lower rate,'" he said. He added that lower rates to commercial consumers will be a benefit to the entire city, stimulating business and improving general conditions. He maintained that a rate reduction should not be considered until 1935, and that in determining city rates the commission should consider the company's properties as a whole and not merely the property used in St. Louis.

Mr. Egan was the last witness called for the company. The city began the presentation of its rebuttal testimony on the following day.

▼

Five Holding Companies Now Under Examination

CONTINUED INQUIRY by the Federal Trade Commission into the affairs of the New England Power Association put on the record on March 20 testimony by President A. R. Graustein of the International Paper & Power Company—a New England Power ally—that the newspaper holdings of the International, whose bringing to light nearly two years ago aroused much criticism, had all been disposed of except three plants in Augusta, Ga., and Columbia and Spartanburg, S. C., where litigation had retarded a quick sale. Thomas H. Carens testified regarding his activities as publicity agent for the New England Power Company. Hearings were adjourned without date.

The commission sent to the Senate March 16 its monthly interim report of progress, showing that examiners are now at work on the books of five large holding companies, while examination of books of an important sub-holding company and of an operating subsidiary of one of the five holding companies is continuing.

LOS ANGELES' NEW CITY HALL FLOODLIGHTED

—Herbert Photos, Inc.

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Are Washington Rates to Go Still Lower?

STILL ENDEAVORING to bring about a reduction below the 4.2-cent residential rate now in force in Washington, D. C., the District Public Utilities Commission, which asserts that the Potomac Electric Power Company is enjoying a return of more than 10 per cent, is urging that company to join with it in asking the District Supreme Court to modify the equity-consent agreement between the commission and the company under which rates are now fixed. The directors of the company were to consider the matter at a meeting set for this week.

Should the power company refuse to go into court voluntarily with the commission seeking modification of the decree, the commission has set forth four alternative procedures one of which it may take. These are (1) to petition the courts for modification on its own initiative; (2) to modify the decree itself without going into court and then fight the company's appeal; (3) to revalue the company's property and fix a new and probably a much lower rate on the valuation; (4) to enter into a bi-party agreement with the company, fixing a sliding scale to supplant the consent decree, as was suggested previously by People's Counsel Keech, and not go into court.

The company's present rate is said to be lower than the corresponding rate in 50 other large American cities.

Scattered Happenings in the Electrical Sphere

United States

MOREHEAD CITY, N. C., has sold its municipal power plant to the International Public Utilities Corporation for $350,000, with a franchise for 50 years.

THE IOWA PUBLIC SERVICE COMPANY of Sioux City has acquired transmission lines and distribution systems in ten communities in Nebraska and South Dakota through interchange of properties with the Interstate Power Company of Nebraska. The Big Sioux plant of the Iowa Public Service will furnish power, and the acquisitions will be operated as the Nebraska Public Service Company. Iowa Public Service properties in scattered areas 75 to 100 miles from Sioux City were given in exchange for the group, thus effecting more closely knit distribution. The Iowa Public Service Company has sold the plant at Neligh to the Interstate company, and at Hartington, where the Interstate was unable to obtain court protection for its rates and property, the City Council has been informed that the plant will be closed down unless the repurchase option is eliminated from the franchise.

CONTESTING BEFORE the United States Supreme Court a state assessment for taxation purposes of $11,136 an acre on 2,110 acres of submerged land in Maryland, the Susquehanna Power Company, which operates the Conowingo Dam, declared that the dam had been authorized by the federal authorities to aid navigation and that therefore the land was exempt from taxation. Counsel for the state called this a change of front on the part of the company, which, it was stated, had in the state courts merely challenged as excessive the value placed on the lands.

REORGANIZATION OF THE Interstate Public Service Company of Indianapolis has been proposed in a notice to stockholders recommending that the name of the utility be changed to the Public Service Company of Indiana.

ALLEGING THAT ERECTION by the Indianapolis Power & Light Company of 90-ft. electric light towers carrying a 132-kv. transmission line has made the Capitol airport in Indianapolis useless, owners of Capitol Airways, Inc., have filed suits against the utility, demanding damages of $400,000.

THE COMMERCIAL SECTION, Middle West Division, N. E. L. A., held a successful electrical advertising school at Omaha March 12 and 13 with approximately 100 in attendance and exhibits by 20 manufacturers.

DE SOTO FALLS, 104 ft. high, on Little River in the Lookout Mountains of northeast Alabama, which was formerly used as the power source for a small plant, has been dedicated to scenic uses only by the De Soto Falls Development Company, which has taken it over from the Alabama Power Company.

THE MIDLAND COUNTIES PUBLIC SERVICE CORPORATION has been authorized by the California Railroad Commission to transfer its properties and operating rights to the San Joaquin Light & Power Company on or before June 30.

CLEVELAND'S CITY COUNCIL has announced a series of hearings on the question of expanding the municipal light system. City Utilities Director E. H. Krueger says that expansion of the plant will be necessary if the Council adopts the proposed ten-year program of street lighting, but this, he said, will not be carried out unless property owners bear a part of the cost of maintenance.

▼

Coming Meetings

Southeastern Division, N.E.L.A.—Vinoy Park Hotel, St. Petersburg, Fla., April 1-3. C. M. Kilian, 508 Haas-Howell Bldg., Atlanta, Ga.

Arizona Utilities Association—Biltmore Hotel, Phoenix, April 8-11. J. S. Arnold, 300 West Washington St., Phoenix.

Great Lakes Division, N.E.L.A.—Engineering Section, Chicago, April 9-11. L. F. Hickernell, Consumers Power Bldg., Jackson, Mich.

Maryland Utilities Association—Lord Baltimore Hotel, Baltimore, April 10. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

Northwest Electric Light and Power Association—Accounting Section, Salt Lake City, April 13 and 14; general convention, Boise, Idaho, June 17-20. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 16-18. F. D. Beardslee, 315 N. 12th St., St. Louis.

Southwestern Division, N.E.L.A.—Mineral Wells, Tex., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Electrochemical Society — Hotel Tutwiler, Birmingham, Ala., April 23-25. C. G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—District meeting, Rochester, April 29-May 2. F. L. Hutchinson, 33 W. 39th St., New York.

East Central Division, N.E.L.A. — Deshler-Wallick Hotel, Columbus, Ohio. May 11-13. D. L. Gaskill, 603 Broadway, Greenville, Ohio.

National Electrical Manufacturers' Association — Hot Springs, Va., May 18-23. A. W. Berresford, 420 Lexington Ave., New York.

Middle West Division and Nebraska Division, N.E.L.A.—Excelsior Springs, Mo., May 20-22. Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

National Electrical Credit Association—Hotel Pennsylvania, New York, May 21 and 22. F. P. Vose, 1008 Marquette Bldg., Chicago.

National Electrical Wholesalers' Association—Hot Springs, Va., May 27-30. E. Donald Tolles, 165 Broadway, New York.

Wisconsin Utilities Association — Accounting Section, Racine, May 28-29. J. N. Cadby, 135 W. Wells St., Milwaukee.

National Electric Light Association—Atlantic City, June 8-12. A. J. Marshall, 420 Lexington Ave., New York.

AFFIRMATION WITHOUT OPINION by the Supreme Court of the United States of the decision of the Supreme Court of Wisconsin in Nekoosa Edwards Paper Company vs. Railroad Commission, involving the validity and application of the 30-year recapture clause of the Wisconsin water-power act, is announced. The case concerned a permit for a project on Four-Mile Creek, a tributary of the Wisconsin River.

CITY COMMISSIONERS of Asheville, N. C., have been asked to submit to the voters a proposed franchise for the Independent Power & Light Company, which wants to build a plant on the French Broad River to compete with the Carolina Power & Light Company.

Canada

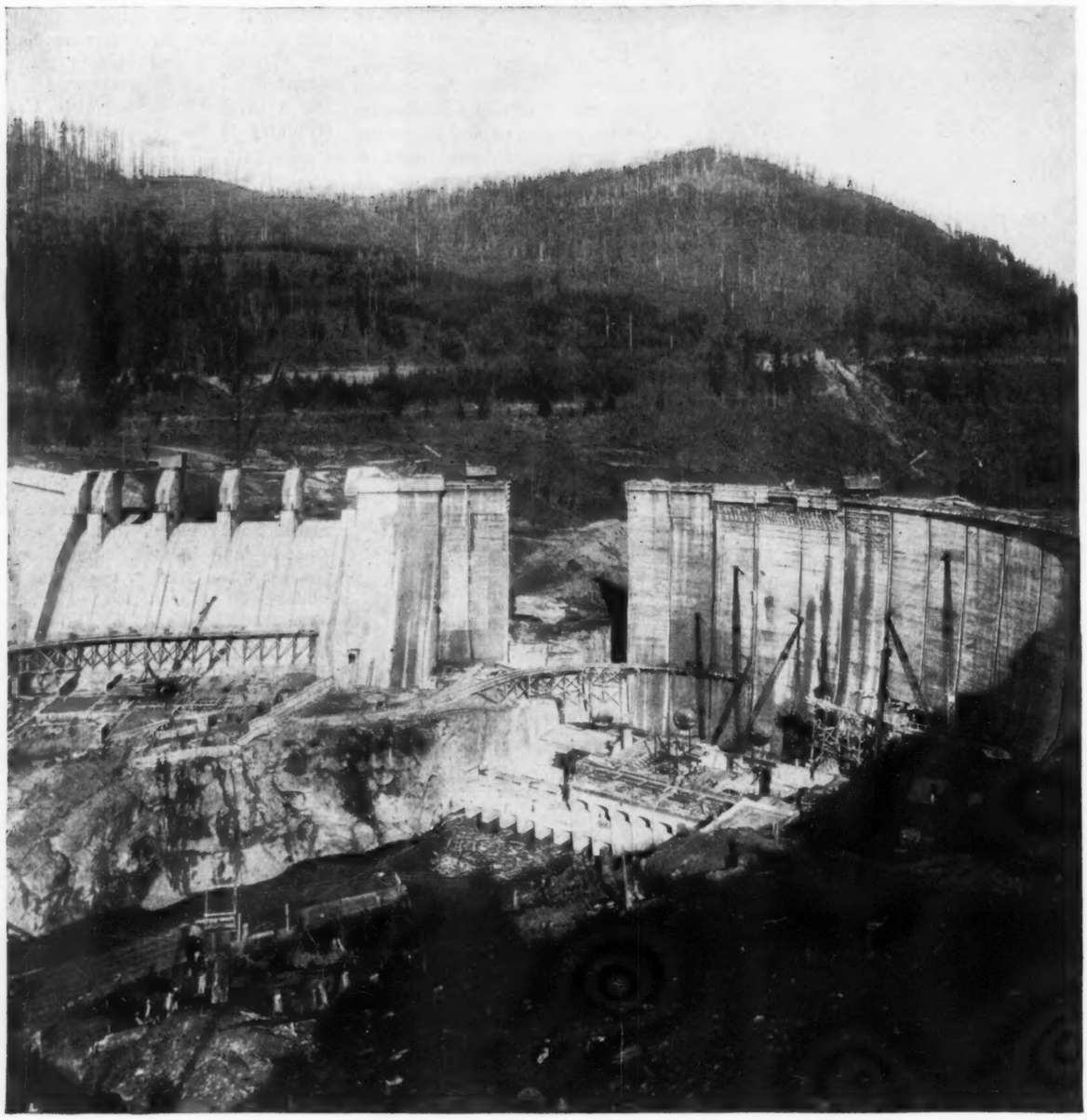
CHARGES THAT THE Hydro-Electric Power Commission of Ontario has become subordinate to private interests, that its contracts with Quebec companies are one-sided and that it exports power from Niagara Falls to the United States and replaces this at heavy expense by long-distance importations from Quebec were aired in the Ontario Legislature on March 19. The charges were made by G. A. McQuibban, chief Opposition whip, who, among other things, said that the commission exported 122,000 hp. from Niagara and to compensate for that bought 122,000 hp. in Quebec, paying an "exorbitant price." Premier Henry pointed out that the exported energy was peak-load power and was exported on a long-term contract entered into by a company which the Hydro had taken over. Other members defended the contracts with Quebec utilities as a wise provision for future needs, especially in view of the delay in developing the St. Lawrence.

Abroad

AN ELECTRIC SUPPLY SCHEME just approved by the County Council of Dumfries, Scotland, involves main distribution lines about 190 miles long and subsidiary lines extending 135 miles. The Dumfriesshire Council will, it claims, be the first in the United Kingdom to propose to undertake the distribution of electric power throughout its whole area.

CONSTRUCTION OF A 42,000-KW. hydro-electric plant on the Tenryu River, Japan, is being planned by the Daido Electric Power Company, at a cost of 12,000,000 yen, according to *Denkinotomo*.

THREE BRITISH FIRMS have obtained contracts for electrifying a 60-mile stretch of the Budapest-Vienna railway line from the Hungarian capital to the Austrian border. This is regarded as the first step toward transforming the whole Hungarian railroad system.



ARIEL—

220,000 acre-ft. of seasonal storage

Single-arch, variable-radius dam provides 185-ft. head.
Spillway will pass 100,000 sec.-ft.
One 45,000-kw. unit, initial installation, four eventually.
Outdoor gantry crane spans generators and outdoor transformers.
No low-tension bus or switching.
Interconnected with northwestern utilities.
Owned by Inland Power & Light Company, Portland, Ore.

EDITORIALS

L.W.W.MORROW
Editor

Sharing the honors with the commissions

VOLUNTARY reductions in electric rates have been of common occurrence in the last few years. They are often so commonplace as to fail to redound to the full credit of the companies which initiated them. On the other hand, much of the doubt about the efficacy of the regulatory commissions originated in the popular belief that they could not have been fully "on the job" as long as they appeared oblivious to these opportunities for lower rates and were apparently caught unaware by the magnanimous proposals of the utilities.

Few of the well-informed, however, believe that the commissions were not cognizant of the possibility of passing on to the ratepayer the accumulating economies in production and distribution of energy. The real deterrent has been their lack of authority to initiate rate investigations, or, where such authority existed, fear of the consequences of protracted litigation and the risk of reversals by the reviewing courts on reductions that appeared to be as drastic and spectacular as those voluntarily announced.

Informally negotiated rate revisions have their pitfalls, too. The critical part of the public may be disposed to feel that compromises arranged under the flexible conditions of informality are likely to lack the preciseness and thoroughness of formally adjudicated rates. But the combination of volition on the part of the company and acquiescence on the part of the commissions is well worth while for its confidence-inspiring effect on the obstreperous critics of the utilities. The commissions, too, at the moment need all the credit they can acquire in order to re-establish public confidence weaned from them by political attacks. As long, then, as negotiated rate reductions can be undertaken under the regulatory statutes there should be a disposition to resort to this procedure, and full publicity should be given to the negotiations.

Investigate causes of failures

NO MATTER how reliable the equipment, how competent the design and construction of a plant or how careful the maintenance and operation, there will be accidents that will cause shutdowns of a type that will have to be recorded as unavoidable. There are, however, other and avoidable shutdowns caused by faulty material, incompetent station design, incompetent construction or incompetent operation and maintenance. Each shutdown, whether avoidable or not, should teach a lesson, and in order that it may do so it should be investigated and classified.

Two recent cases of cable failures in both of which an important district was without any supply of energy for a considerable length of time will illustrate the point well. In each case the breakers failed to open, and in each case the generator was taken off the bus to clear the short circuit. But the causes were quite different: In one case the protective device was quite remote from the bus and the short circuit happened in the cable between the bus and the protective device. Apparently this shutdown could have been avoided had there been competent designing. In the other case the protective device was in the proper location, but the breaker failed to function through some fault either in the tripping circuit or in the tripping mechanism. Moreover, it took the operator some time to find out which circuit was in

trouble. Apparently this was a case of incompetent operation and maintenance. Under the worst conditions the ammeter or the relay operation indicator should have told the operator at once which circuit was at fault and the particular breaker should have been cleared manually. Furthermore, when a modern breaker fails to function there is always cause for suspecting incompetent inspection and maintenance.

In both cases the first report was "bad cable," which was true as far as it went. But bad equipment—not only cable—must always be contended with. That is why there are breakers, that is why there are relays, and that is why there are operators. In these cases competent investigations traced the first shutdown definitely to incompetent design and the second shutdown definitely to incompetent operation. It is not always possible to establish definitely the cause of a shutdown, but the attempt should be made and a shutdown should never be put down as unavoidable until all other possibilities are analyzed.

Faulty argument

SOME local interests have challenged the justification of the Pennsylvania Railroad electrification, the newspapers report, on the ground that it will "kill the goose that lays the golden egg." Stating it a different way, these coal interests are reported to assert that electrification will displace a large volume of bituminous coal as industrial and railroad fuel in the section traversed by the line and, furthermore, that such substitution threatens railroad revenue from hauling coal, which in 1929 totaled $134,000,000.

This sort of argument would bring no credit to the coal industry. First of all, coal will still be burned to generate 75 per cent of the power in the East. If increase in the economy of combustion is criticised, coal interests should be ashamed to admit it. Furthermore, it is difficult to see how the Pennsylvania Railroad will lose revenue by discontinuing the hauling of its supply coal.

Critics of railroad electrification apparently are not aware of the specific benefits derived from electrification by twenty-two railroads in the United States and many in foreign countries. They should be referred to various available reports. Instead of trying to obstruct electrification and purchased power, the coal industry should be glad to encourage both, because without the aggressive efforts of utilities to increase the use of electricity, and consequently the consumption of coal, the coal industry might be in a worse situation than it now is.

In turn, the coal industry has the right to expect from any buyer a price that will bring a reasonable profit above efficient overhead and operating expenses, specifications which are the same for all bidders, secrecy regarding bids offered until contracts are closed, and elimination of the not infrequent demand to shade bid prices.

Panel heaters developed for room warming

ANOTHER interesting electric heat idea is being tried out here and abroad. Upon the assumption that highly concentrated heat sources are unsuitable and uneconomical, metal panels or plates heated uniformly by removable elements, located in longitudinal cores cast integrally with the rear face of the plate, are installed. The plates may be mounted under window frames as pseudo baseboards, as wall panels between windows or elsewhere, or in the ceiling. Each plate is thermally insulated from the wall with a backing of incombustible and non-conducting material.

Virtually invisible and operating at low temperatures (the embedded resistance wire is run well below incandescence), these devices eliminate shortcomings of the customary convection heating and strike a most modern note. Built-in lighting and built-in heating are architecturally incorporated in the design of the room. Ceiling heaters are said to offer notable advantages and are esteemed preferable in many instances. Thermostatic control is used.

To these advantages add the further element of economy and there is a good story to be told of a potentially powerful rival to present practices. English standards of adequate room warmth, and consequently of operating economies, as well as fuel costs, differ somewhat from ours in this country, but in a recent address before the Association of Supervising Electrical Engi-

neers (England) R. Grierson cited definite economies. Instead of the ratio of cost between coke and electricity for house heating being 1 to 17 as electric-heating-through-water-storage advocates overseas are said to have suggested, Mr. Grierson's estimate on the basis of low-temperature panel heating is 1 to 1.73. In the case of one building the comparative operating costs secured by test for a period covering October to May were approximately $235 for coke and $210 with the low-temperature panels. First costs are low too. Here may be just another of the many amazing things which will lead to further development in the electrical industry in the next ten years.

Sacrificing trade relations by carelessness

NOT long ago an ELECTRICAL WORLD editor was investigating the situation in a locality where the power company has established a progressive appliance merchandising policy. This policy is particularly favorable to the dealer. It permits a profitable participation by him in the retailing of domestic equipment, with promotional rates and easy-payment financing. It encourages co-operation with the trade. Several dealers were actively "tying in" with the program. Some seemed little interested and the reason was sought. It developed that these dealers did not understand the plan—thought it was all in the interest of the utility and were inclined to be critical and antagonistic. When the picture was made clear they were surprised and immediately became interested and eager to take part.

It is perfectly obvious that in this and many other cases trouble in trade relations has been due, not to unfair policies of merchandising, but to the failure of the power company to "sell" its plan to the dealers. Sometimes the attitude is close to indifference, but more often it evinces a lack of thorough preparation. Such plans may be clear indeed to the utility men, but they assume too readily that it must also be clear to the dealers, because it has been explained in a letter or a meeting. An explanation is not enough. The plan must convince. The dealer must want it for his own sake before it will work—and that takes selling. It is worth the trouble, for only by enthusiastic co-operation is it possible to make a co-operative plan succeed.

Watch the hydro possibilities

PREDISPOSITION of judgment frequently results in mistakes that cost money. The rising efficiency of generating electricity by steam power has caused engineering opinions to be closely critical of the cost of hydro-electric generation. This mental attitude is just as liable to lead to error as was the prevailing disposition of a few years ago to admit without argument that water power was the cheaper.

Particularly is this true of systems that once relied heavily on hydro generation but that now as loads have increased greatly beyond installed water-power capacity are preponderantly steam generation systems. In these systems base loads are now carried by steam and the hydro capacity is used for peak supply. The tendency is for additions to system capacity to be made in steam plants. This is because of the now accepted belief that generation by steam is the more economical. While this may be perfectly true in terms of firm power in any single case, in terms of peak energy it may be very wide of the mark. As systems grow hydro capacity may assume increasing value in terms of peak cut-off. Although the availability of water fixes the quantity of annual kilowatt-hours and that quantity remains unchanged, its value to the system may be several times what it was a few years ago when the system load was much lower.

Careful studies carried out in the light of present-day conditions may show that a hydro-electric development wholly uneconomical in terms of firm system capacity on the basis of the system load factor may be highly economical in terms of much greater peak capacity at the lower load factors represented by the summits of the system's peaks. Or it may be possible that a water-power plant installed a number of years ago and still grinding out kilowatt-hours day after day may come to have a much greater value in terms of peak capacity by the doubling or tripling of the installed hydro-electric capacity.

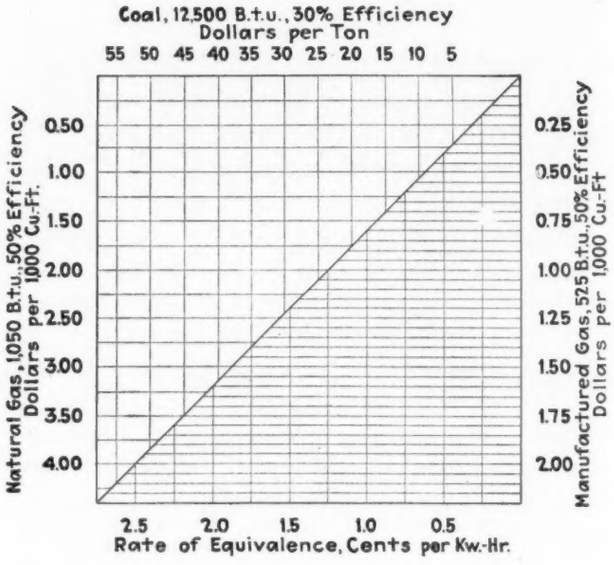


Fig. 1—Equivalent comparisons of coal, gas and electricity for house heating

Use of Off-Peak Energy

By L. G. DE KERMOR

President Fireless Electric Boiler Corporation, New York

Domestic market for home and hot water heating. Economic comparisons. New type of heater. Automatic control of use from station or substation. New principle of heating

APPLICATION of electric energy to the production of steam or hot water was considered an economic heresy until lately. It has taken a long time to dispel a belief heretofore so firmly and generally held. Today the situation has changed, as the tremendous possibilities of practical electric heating have been conclusively demonstrated and are at last fully understood.

At first electric heating received a great deal of attention in European countries where there existed a scarcity of coal, but the greatest developments have taken place in Canada, where, during the last seven years, a great number of installations have been made, ranging in size from the small water heater for home use to the large 25,000-kw. high-pressure units of the pulp and paper mills.

It was first developed for the primary purpose of providing means for the conversion of the growing amount of daily or seasonable waste energy—by-products of nearly every hydro-power system—into a valuable and useful asset. It should not be forgotten in this connection that only one-tenth of the water power of this country has been harnessed so far, and that as the development of this available power takes place, so will the amount of waste energy steadily increase to alarming proportions unless some practical ways of reclaiming it are made available. A similar condition is developing now in steam-electric plants, where additions have to be made continuously to meet the ever-growing demand at the peak hours. In their case the cost of additional energy at off-peak times is almost limited to the cost of the additional fuel.

It is therefore to the great advantage of both the hydro and the steam-electric plants to do their utmost to create new demands for waste or off-peak energy, and it can be fairly stated that the electrification of boilers and heaters is one of them.

In the industrial field, which, on account of the low figures of equivalence, has been confined until the present day to energy developed from hydro-electric systems, it is purely a commercial proposition and may be either desirable or undesirable, according to local conditions. Each case, therefore, should be studied and decided upon its merits, but there is no doubt that any installation specially designed to use exclusively off-peak power will be very favorably considered by the power distributors.

In the domestic field the possibilities are almost unlimited, as the low all-winter average efficiency of home boilers, added to the craving for additional comfort and convenience, makes possible the use of electricity at much higher rates than those possible in industrial plants, without unduly increasing the present normal cost of heating.

The domestic field, furthermore, is no longer confined to hydro systems or off-peak periods. The improve-

ments of the last fifteen years in the means of production of steam-electric energy, and the consequently very important reduction in the amount of fuel previously required therefor, have opened the way to electric heating in the home on a great number of the steam-electric systems on terms just as favorable as those found on hydro-electric systems.

It can therefore be truly stated that while the industrial field is very interesting and should not be neglected, the real opportunity for both the power distributor and the manufacturer of electric heating devices is in the smaller types, which make of every one a possible purchaser, the types that can be produced in large quantities at low cost and sold through the medium of national advertising and distribution. An electric boiler in each home is the ultimate purpose, and the reasons are obvious:

(a) While the industrial field requires extremely low rates on account of the high efficiency of its modern steam plants, the poor efficiency of the average house installation permits the use of electric energy at rates

	Group 1	Group 2	Group 3
Lowest temperature in deg. F.	—48	—10	3
Maximum difference of temperature, deg.	120	82	69
Degree-days	11,500	7,500	6,050
Total installations in cubic-feet of space heated:			
(a) Electric	2,835,000	1,124,000	257,000
(b) Coal	2,903,000	1,115,000	261,000
Total Winter Consumption			
(a) Electric in kilowatt-hours	6,296,431	1,622,062	384,443
(b) Coal in tons	2,606	762	190
Average B.t.u. contents in coal	11,500	12,500	12,500
Average consumption per 1,000 cu.ft. of space:			
(a) Electric in kilowatt-hours	2,200	1,425	1,456
(b) Coal in pounds	1,795	1,368	1,465
Electric energy per pound of coal in watts	1,237	1,041	1,000
Total maximum demand in kilowatts	2,862	811	155
Average maximum demand per 1,000 cu.ft. space in watts	1,000	721	628
Average all winter coal efficiency, per cent	36	28	26½

Note: The average efficiency of the coal burners of each group has been computed by straight comparison with the amount of electricity used in electric boilers having a known and proved efficiency of 98 per cent.

from four to six times higher. This condition easily offsets the larger cost of energy distribution and allows a much greater net return to the power companies.

(b) While the installation of electric boilers in industrial plants means the dismissal of a large number of men—engineers, firemen, etc.—in the home it adds to the material comfort of the householder and relieves him from a very distasteful task.

(c) While industrial installations are possible only on a limited number of hydro-electric systems, home or water heating can economically be installed on a great number of the distribution systems of the United States, a proportion possible of large increases owing to the desire of every electric energy distributor to improve his load factor by offering very attractive rates to the users of off-peak energy.

The possibilities for development of electric heating being limited only by the cost of operation of

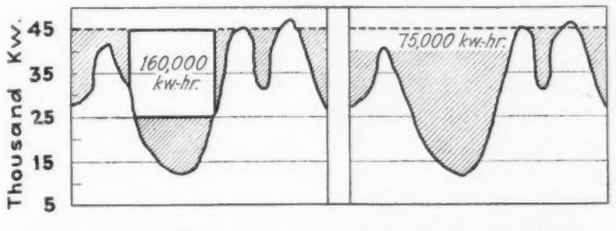


Fig. 2—If off-peak heating is concentrated the customer's storage system must be enlarged

The author of this article has spent many years in Europe, Canada and the United States in developing electric boilers and electric hot water heaters. Many industrial and domestic installations in Canada, especially, give him a background of experience from which to discuss this important aspect of market development.

any electric heating device, the question, therefore, is to see if power distributors can, at the same time, allow practical rates and find a sufficient remuneration in this kind of service.

To arrive at a definite conclusion on this point, it was first necessary to ascertain the rates at which electric energy could compare favorably with other fuels. With this objective in view, comparisons have been made between several large groups of houses of as much similarity as possible in every respect, one house electrically heated for one using a coal-fired boiler, and the results of three groups were found to be as shown in the table opposite. From the figures it can be deduced that the maximum connected load necessary for electric heating is equal to 9 watts per 1,000 cu.ft. per maximum degree difference in temperature and that the average consumption is equal to 200 watts per 1,000 cu.ft. per degree-days in colder climates where houses are built with better care, proper insulation, and are fitted with storm doors and windows, whereas it requires 250 watts per 1,000 cu.ft. per degree-day, or 25 per cent more, in the milder sections where houses are not built to withstand extreme temperatures.

It is to be noted that while in the dry cold weather of the Northwest the average house is kept at a temperature of 70 or 72 deg. F., the people living in the Eastern and Southern sections maintain their houses between 74 and 78 deg. This condition should not be neglected in the computation of cost of operation, for an increase of 6 to 8 deg. in the average temperature means an addition of 1,200 to 1,600 to the number of degree days and of 20 to 25 per cent in the amount of kilowatt-hours that are consumed during the winter season.

Comparison on fuel cost basis

By straight comparison of the cost of fuel alone, it is found that the rates at which electric energy would have to be obtained vary from 0.4 cent for replacement of coal at $10 a ton, used at an efficiency of 36 per cent, all the way up to 1.22 cents for coal at $20 a ton, at an efficiency of 22 per cent. This, however, is not the rate of equivalence to be taken in the majority of cases, for the class of householders

that becomes interested in electric heating is not, in general, tending its furnaces, and either hires the services of a furnace man or pays some extra wages to the usual help for this additional winter service. The cost of such service varies from $80 to $100 for the winter in the colder places to as low as $35 to $50 in milder places. All in all, it is found to correspond to about $5 per ton of coal, so that without any consideration for the added convenience, comfort and cleanliness, the rates of equivalence with coal, including the $5 per ton for service, as well as that with natural and manufactured gas, should be as shown in Fig. 1.

It is obvious that, with the willingness of the modern householder to obtain a greater amount of comfort and convenience at additional cost, a good number of electric home-heating and an almost unlimited number of water-heating installations are possible wherever 24-hour service can be obtained at rates under 1.5 or even 2 cents per kilowatt-hour. It is even more so in the case of garage heating, where only a small amount of heat is required to keep the temperature above freezing point.

The real field for electric heating, however, is where rates from 1 cent per kilowatt-hour down are to be found, but except on hydro-electric systems and a few steam-electric plants no such rates are available for 24-hour service. Steam-electric systems, however, have the means of producing energy at low costs, and at practically no additional capital expenditures during the off-peak periods of the 24-hour day, more particularly at night. These periods vary in length of time according to each system, and the cost of production of the additional energy, including additional fixed charges, maintenance and losses, is found between 4 and 5 mills per kilowatt-hour sold.

Profitable business at off-peak rates

The consumption of a home-heating installation going all the way from 25,000 to 100,000 kw.-hr. per winter season, at the average production cost of 4.5 mills per kilowatt-hour each service, shows a net profit of $137.50 to $550 to the distributor with a rate of 1 cent per kilowatt-hour, while the average water heater with a consumption of 4,800 kw.-hr. gives a net profit of more than $25 per year, regardless of the improvements in the load factor and the efficiency of the whole system.

This is, therefore, a good and profitable business. A number of power distributors have already taken advantage of this new field, and having established the necessary rates, are encouraging and facilitating the installation of electric-heating equipment. Their efforts have been more specially applied to water heating for the obvious reason that, requiring a smaller investment from the prospective user, it offers less sales resistance, and that, being either a twelve-month load or, if seasonable, a summer load, it was considered as one of greater benefit to their systems.

In the long run, however, it will be found that both home heating and water heating are needed to hold the load factor of the generating station to the point of most economical production at all times. It must be borne in mind that the electric water heater, bound as it is to find its way in almost every home as a summer complement to the heating plant, will, on account of its great numbers, create a very important drop in the demand when shut off at the beginning of the winter season. It is obvious that the best correcting factor is to be found in the simultaneous seasonable demand of the electric home-heating installation.

The utilization of off-peak energy in electric heating is closely bound to heat-storage systems, for the shorter the time in which off-peak energy is available in each cycle the larger the storage capacity and the connected load to be provided for. While this phase offers no problem in the storage of hot water for domestic service in the heating plant of a good-sized house, it might develop into an installation so bulky as to become objectionable if the hours of service were curtailed too much. This

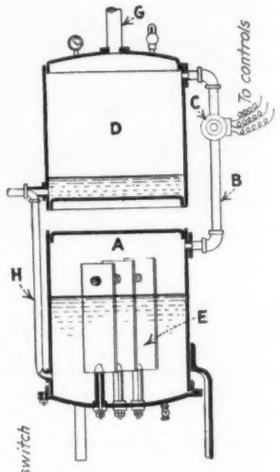
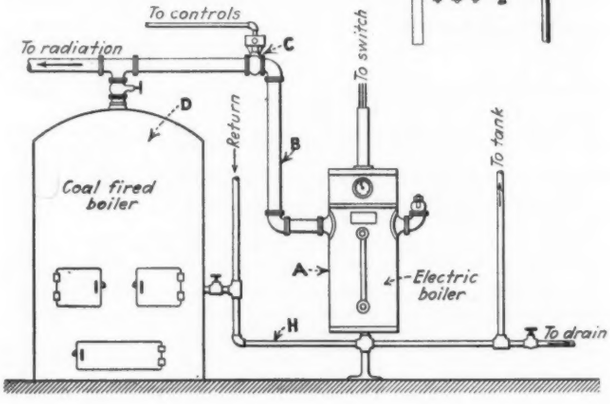


Fig. 3—Water resistance heater showing electrodes and automatic control

Fig. 4—Heating boiler for household use
14 in. in diameter and 32 in. high



serious problem seems, however, to have been solved satisfactorily by changing the storage medium from water to chemical components, such as diphenyl, which can absorb a great amount of heat without building up a pressure, the result being the reduction by six of the storage capacity needed in each case.

A short off-peak service would, in many instances seem more beneficial to the power distributor, but, being to the disadvantage of the prospective user, it would meet with his opposition and could become a deterrent to the quick development of this new field. A good illustration of this point can be found in the load curve given in Fig. 2. It shows that 5,000 kw. of off-peak capacity can be supplied for fifteen hours, a total energy of 75,000 kw.-hr., but that if the length of time is reduced to eight hours—at which point the largest available block is found—the off-peak capacity increases to 20,000 kw., a total energy of 160,000 kw.-hr.

It is obvious, therefore, that the shorter period, if practical, would be more attractive to the power distributor, although it would allow the use even then of only 45 per cent of a possible production of 355,000

kw.-hr. at off-peak times. However, the longer period would be expected by the user of energy, for it will mean a reduction of 35 per cent in the size of his storage system and a proportionate saving in the cost of the whole installation.

Some power distributors have endeavored to solve this problem by the use of several heating elements in the same storage system, each element under separate control, timed to open or close according to the availabilities of the system. This, however, is a rather complicated solution and almost prohibitive on account of the cost.

Time controls, as used now, offer only a temporary and imperfect solution, for special off-peak rates will bring new demands of energy which might change the off-peak periods of today into the peak hours of tomorrow. They will, in any event, considerably offset the periods and length of time at which off-peak energy will be available. Under such conditions time controls will have to be readjusted to the ever-changing conditions and, even with the most expert and careful attention, they will never have the flexibility needed to enable the distributor to command at will part of the heating load to meet some unexpected demand elsewhere, such as breakdowns, concentration of lights or power for special purposes or the turning on of lighting systems at the sudden coming of a storm, etc.

Power plant control of energy use

The ideal condition is to be realized by placing the control of the heating load at the power plant, a control of such versatility as to make it possible for the man in charge to vary and limit the total heating load demand to the exact off-peak capacity available at each and every moment of the day, thereby making of this demand the stabilizing factor for the better and more economical operation of both power plant and distribution system.

This perfected method of control is available now. It requires, of course, some new equipment at the power plant and a small control at each point of service, but the total cost does not exceed that of the present time controls. Furthermore, its installation can be delayed until such time as the number of services on the system will make it imperative and therefore warrant the expenditure, provided the power distributor prepares for such contingency by insisting on heating units easily adaptable to the new system of control.

This system is extremely simple and consists of a master control at the power plant which releases high-frequency waves on the lines of the distribution system. The waves, in turn, operate the relay of the synchronized controlling device in the home which, if used in conjunction with any of the latest automatic electric heating units manufactured under De Kermor's patents, adjusts its capacity at any point between the two extremes according to the command of the master control, all the units on the system increasing or decreasing in maximum capacity in the same proportion at the same time.

Although the new control can be adapted to other types of electric units and thereby improve considerably their desirability from the standpoint of the power company, it would be entirely impossible to obtain from them the flexibility of the De Kermor boilers and heaters. This is due to the fact that they are built on absolutely different lines and work on an entirely different principle.

Electric units for the heating of liquids were, from the beginning, and are yet generally, made of coils or ribbons of metallic resistance, inclosed for protection in a metal tubing or a covering of some kind. They are found in all forms and in various capacities and are commonly known as "immersion heaters."

Each heater of this type has a fixed resistance and therefore its capacity can be varied only by rheostatic action. In practice this is obtained by using them in multiple and, through a proper switching arrangement, operating them separately, in parallel or in series, and obtaining thereby a limited number of steps between the high and low capacities.

Water resistance heaters

The De Kermor boilers and heaters are of the water resistance or electrode type and entirely automatic in operation. They are only applicable to alternating-current circuits, either single- or multi-phase, and of any potential from 110 to 6,600 volts. In the home sizes, however, their voltage is limited to 110 and 220 volts, except for capacities over 75 kw., when they are made for 550 volts. These heaters are available as substitutes for almost any kind of hot water and steam installation, for either low or high pressure, and can be used either independently or in parallel with other equipments and either with or without heat-storage systems.

Their control is based on the development of a pressure by the generation of steam at the electrodes. The effect of the pressure is to vary the level of the water in the boiler or heater and thereby the area of contact between the fixed electrodes in the water. This action, similar to that of a rheostat, regulates and limits the flow of current according to the exact heat requirements of the system at all times, the only moving element being the water itself. A notable feature of this type is that, the water being the resistance, the absence of heated surfaces removes all danger of damage to the boiler or heater from overheating or inadequate water supply.

The control of the De Kermor units is, except in minor details, the same in every case and is illustrated by Fig. 3. The electrodes *E* are immersed in the water in chamber *A*. The flow of current from one electrode to the other changes the water into steam, which escapes through pipe *B* and valve *C* into the steam chamber *D* and therefrom by *G* to the distribution system. The throttling of valve *C*, by pressure, thermostat or overload controls, reduces the flow of steam, and its production being in excess of the demand, the steam forces the water out of chamber *A* through pipe *H* into chamber *D* until the decrease in the area of the electrodes immersed in the water has, by rheostatic action, reduced the electric input to the exact proportion needed to produce the amount of steam allowed to escape through valve *C*, until a further action varies again the opening of the said valve and again adjusts automatically the flow of current to the need.

It is easily understood that in practice chamber *D* can be located anywhere. It is generally replaced by the heating boiler already in place, as shown in Fig. 4. The electric boiler needed for the heating of a house is, therefore, very simple in construction and its size extremely small, varying from 14 to 18 in. in diameter and from 30 to 48 in. in height, according to the size of the house.

In the case of water heating, chamber *D* incloses either a coil or a double jacket in which the water to be heated

is circulating, the amount of steam condensed regulating the steam demand instead of the radiation system, as in the case of steam heating, but otherwise the operation is the same in both cases. The size of a water heater required for the hot water service of a house never exceeds 8 in. in diameter and 24 in. in height and that of a water heater for hot water radiation is about the same as that of a steam boiler of the same capacity.

Installations of these heaters and boilers in houses are generally made for atmospheric pressure by means of an open tank, the level of which determines the maximum pressure and makes the installation absolutely foolproof. In such cases valve *C* is adjusted at the beginning for a definite maximum flow of steam, thereby limiting positively the maximum demand of the heater or boiler and avoiding all danger of overload regardless of the water conductivity, and from that set position gradually throttled down, as already explained above.

From the above explanation, it will be readily understood that these heating units have the extreme flexibility required for the heating load regulation by the power plant control system explained in a previous paragraph. Furthermore, they offer no difficulty to the adaptation of the new control, which is limited to the removal of the time-switch and the connection of valve *C* to the relay of the new synchronized control in the home regulated by the master control at the power plant.

There is no doubt, therefore, that in a control of this kind rests the solution of electric heating in the home, the opportunity for the long-desired improvement of the load factor of the distribution system, and that of a downward revision of rates for all services, while allowing the power distributors the substantial remuneration to which they have generally become entitled.

▼ ▼ ▼

Power Plant Prophecy

"We may postulate that the boilers of the future will be gas fired. This means that there need be no coal, no storage provision, no coal-handling appliances. Ash will not be present, and therefore dust catchers and the troubles incident to boiler cleaning may be forgotten. The fuel will be brought into the station through a pipe and the products of combustion, largely carbonic acid and nitrogen, will go out of the chimney in a clean state. The atmosphere will not be polluted with dust and the coal pile on a windy day will not scatter coal dust over the neighborhood."

This prophecy, which is based upon the distillation of solid fuels at points distant from generating stations and which includes the conception of a gas-fired multi-cellular boiler of the tube and header type, located with turbo-generator and auxiliaries in the same room, was made by George A. Orrok at the national meeting of the A.S.M.E. Fuels Division, held recently in Chicago.

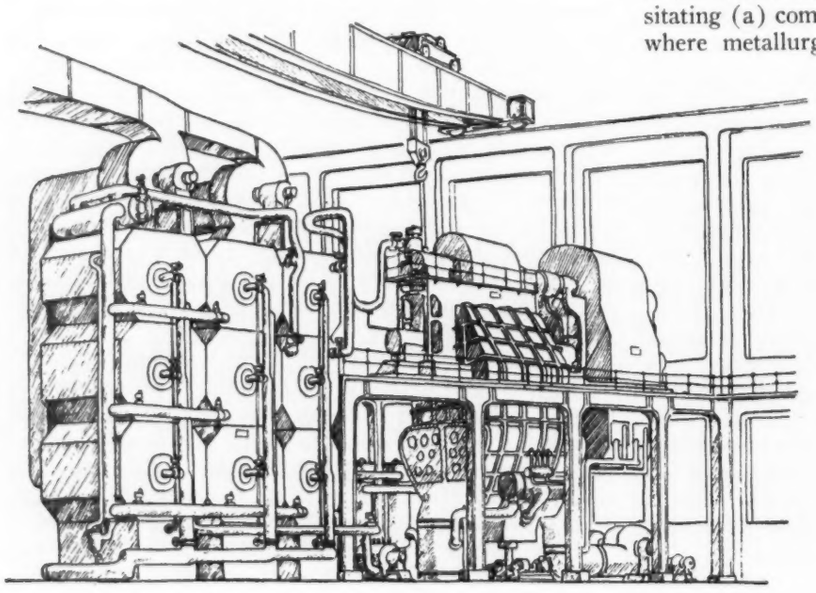
"The boiler of the future," says Mr. Orrok, "will naturally be very much smaller in size than many of those of the present day. With gaseous fuels and the preheating of combustion air the flame can be made exceedingly short and the heat liberation may be quite large. The combustion space, which today is of considerable size, will be much reduced and the speed of the products of combustion through the boiler will be very high in order that the heat transfer may also be high. I am inclined to believe that the boiler of the future might be termed a cellular boiler, in that it will be built up of a number of unit cells, each cell using a certain amount of fuel and generating a certain amount of steam, the number of cells in the boiler depending on the demand for steam. A boiler of this type would be self-contained with its auxiliaries, would make no dust or dirt, could be located in the same room as the turbine and generator and the boiler room as a boiler room would disappear.

"Summarizing, we may state the following conclusions as to the future:

"1. All solid fuel for the making of heat and power in the future will be burned in the gaseous state, necessitating (a) complete gasification plant, (b) coking plants where metallurgic applications are desired and (c) a great development of pipe line transportation for distribution of fuel.

"2. The development of large-capacity boilers of small physical size, using high speed and high heat transfer rate, necessitating (a) excellent burner practice and low excess air, (b) absolute safety in boiler construction and design, very small water content and no large drums and (c) a high commercial efficiency, since installation costs per unit of heat should be much lower.

"3. The practical abolition of the smoke and dust nuisance from solid fuel in thickly settled communities."



The boiler room of the future

Simplification of Diagrams

By JOHN AUCHINCLOSS

General Electric Company, Philadelphia

Advantages of legibility will offset additional expense.

Requirements of draftsmen, engineers and constructors conflict.

Number of symbols must not tax memory.

Difficulty in securing agreement of every one.

Wiring complexity avoided by three-wire groups and use of identifying numbers.

Physical details and relative position not always essential.

Problem of connecting widely separated apparatus.

FROM the manufacturer's point of view there is an economic advantage in a clear, legible electrical diagram which much more than counterbalances any additional time and effort that may be spent upon developing and producing it. There is a direct saving in the time of the engineer who checks it and of the construction force interpreting its meaning in a physical sense. There is also a less tangible, though none the less real, gain in the good will of the purchaser who may have to consult it in solving his operating problems. The chances of error arising in a well-arranged diagram are also much less than in one which is hard to read. This, in turn, means fewer complaints. If a logical method of preparation and arrangement is adopted, the time spent upon the production of a highly legible diagram need not necessarily be any more than that required to produce an aggravating array of meaningless markings. In fact, the former, by virtue of its systematic arrangement, may even require less time in its preparation.

A clear, correct diagram at low cost is a consummation devoutly to be desired, and it was with such an objective in view that some forward-looking switchgear engineers concentrated their attention on the problem of the electrical diagram twelve to fifteen years ago.

Conflicting requirements

In the course of these investigations it early became apparent that before any real progress could be made a system of symbolic representation covering most of the devices associated with the switchboard must be devised. In the selection of such a system, however, several conflicting factors and opposing viewpoints had to be considered. To the drafting room simplicity was highly desirable from the standpoint of expense, to the engineer clarity of function to assist in visualizing the correlation of the whole was of paramount importance, while to the construction foreman elaboration of detail was a weighty desideratum in effecting a ready identification by physical outline of the component pieces appearing on the several drawings supplied to him.

A conflict of interest between the drafting room and the construction force is at once apparent since simplicity and elaboration cannot go hand in hand. The requirement of the engineer, however, is bound up with neither, since a function in itself may be illustrated either austerely or elaborately as may be desired; but as an aid to a rapid comprehension of the relationship obtaining among a group of devices the simple symbol will be found preferable.

Not only had each symbol to satisfy all of these divergent requirements, but their variety had to be kept within the capacity of the average memory, for, manifestly, if their number were too great to memorize, the reading of a diagram would be no less tedious than the task of wading through a book by means of a glossary. This consideration of number led to the adoption of generic forms applying to a complete line of similar functions, entirely regardless of special types. Thus a lightning arrester had but one fundamental symbol, whether it were of the aluminum-cell, oxide-film or auto-valve type. It was agreed that where information regarding type was desirable it would be designated by standard abbreviations placed beside the symbol.

The result was that there finally emerged from the deliberations a group of about 30 symbols, embodying as far as was practicable the requirements of the several divergent interests involved, each one being sufficiently different in appearance from its neighbor to preclude all possibility of mistaken identity.

Agreement of companies difficult

The adoption of a set of symbols for use within a limited organization, however, was one thing, but to insure their application by engineers in general was something vastly different. It is much easier for two heads to reach an agreement than two hundred. But it was very evident that unless these symbols succeeded in appealing to the engineering world and obtained universal recognition in our electrical language comparable with that of the ampere and the watt, their usefulness

would fall very far short of the goal which had fired these men's imaginations and inspired their efforts.

The aid of various engineering bodies was enlisted, and the interest immediately became so highly contagious that for a brief but hectic period it seemed as though the world had gone wild on the subject of symbols. Committees were formed, questionnaires were distributed and the general enthusiasm reached such a pitch that undoubtedly a symbol was proposed and seconded for every variety of electrical device that had ever been manufactured or was ever likely to be manufactured. This was going very much further than had originally been intended and bade fair to wreck all the ideas regarding the adoption of a small number of easily remembered generic symbols.

Like most other outbursts of popular enthusiasm, however, this one also had its heyday and subsided. With the cessation of the clamor more sober councils were again heard, and these eventually prevailed, so that in the final analysis most recognized symbols in use on electrical diagrams today are almost identically the fruits of the early discussion of well over a decade ago.

Avoiding wiring complexity

Contemporaneously with the investigation into the question of symbols, other matters pertaining to the improvement of the electrical diagram also engaged the closest attention of the investigators. During the adolescent age of its growth the devices mounted on the switchboard had been few in number and the controlled apparatus had been simple. The number of wires to be accommodated on the diagram had been correspondingly few and their arrangement was consequently a matter of no great moment. As stations grew in size and complexity, however, the number of switchboard devices and the number of wires required for their connection grew with them, and it soon became apparent that some thought must be bestowed upon the arrangement of these wires if the early simplicity of the diagram was to be maintained amid this rapidly growing complexity.

The method of crossing wires by means of half-loops, still sometimes seen, had long been abandoned in favor of simple crossed lines, but little attention had so far been given to assembling lines in easily distinguishable groups. Heretofore six, eight or even ten small lines might be run closely together in one group, resulting in a tremendous tax on the optic nerve when the attempt was made to follow an individual wire from one end of the group to the other, accompanied by a natural feeling of uncertainty as to whether or not the wire had been correctly traced.

Three-wire groups aid legibility

To overcome this difficulty a rule was adopted that not more than three wires should be run in any such group. These three wires were closely spaced within the group, but a liberal space was allowed between groups to render them readily distinguishable one from another. Three was adopted as the maximum permissible number in a group, for the reason that, besides making the group easy to follow, the three wires themselves were also readily identified at any point in the run as the left-hand wire, the middle wire and the right-hand wire. It was therefore no longer necessary to follow the individual wire but only the group, since the particular wire could be picked up anywhere throughout its length merely by its position in the group.

A similar idea, but vastly different in application, has been adopted by other organizations, though avoided wherever possible on switchgear diagrams. In this method the three-line group is displaced by a multi-wired cable into which the individual wires enter at various points and lose their identity in a series of numbers. If the wires also leave the cable at different points, the task of remembering the number while looking for the point of emergence is very trying, the function of the wire being frequently forgotten by the time it has been traced and identified at some remote point on the diagram.

Where the wires are actually carried in a specially formed cable, such as are used in street-car work, this method may be permissible or even desirable; but for ordinary open switchboard wiring it has little to commend it, unless, as occasionally happens, lack of space may preclude the use of the three-lead method already described.

Where extremely complex electrical arrangements are involved the possibilities of the ordinary diagram are circumscribed by too much necessary adherence to physical detail to permit a clear exposition of the nature of the action which is taking place. In contemplating the combined operation of a series of correlated functions the mind of the engineer should not be distracted by an excess of detail.

To facilitate such concentration of thought was the primary purpose of the elementary diagram. This diagram is merely an attempt to illustrate on paper a scheme of operation which can be readily understood and from which all extraneous material has been rigidly excluded. It is entirely devoid of any limitations imposed by the physical appearance of the devices and partakes more of the nature of a chart. It is not a connection diagram in the true sense of the word, although to expedite the location of faults it is desirable that the physical order of its function symbols shall agree with the installation order of their corresponding devices. Its principal application is in connection with automatic and semi-automatic sequences.

When physical position is important

Another innovation which has aided considerably in checking the wiring on an assembled switchboard perhaps also deserves some notice. This departure from previous practice was incidental to an attempt to produce a diagram more in conformity with a pleasing arrangement of—and with the avoidance of crosses in—the physical wire as finally assembled on the panel. It consisted of a closer agreement between the order of the various devices on the diagram and their physical arrangement on the switchboard itself. To enable the work on the diagram to proceed without awaiting completion of the physical drawings, however, certain location standards had to be rigidly followed on both; otherwise the discovery of subsequent discrepancies might lead to costly revision on one or the other. Even with the aid of such standards no arrangement of devices to scale was ever attempted on the diagram, the adherence to location being merely relative but nevertheless sufficiently accurate to assure reasonable agreement between the physical wiring and the diagram.

This policy enables the manufacturer to provide a

switchboard purchaser with advance information regarding the most probable order in which his conduits should come to the switchboard. Even if such advance information is not required, the purchaser at least receives a switchboard the physical wiring of which bears some resemblance to the diagram he received some weeks or months previously. This could not be said of the switchboards and switchboard diagrams produced a decade and a half ago.

To carry out the idea of conformity between the diagram and the physical arrangement of the apparatus, on control equipments involving a remote location of current and potential transformers, oil circuit breakers, etc., some method had to be devised of eliminating long runs of group leads between the switchboard and the more distant devices. Not only did such runs entail a considerable amount of drafting but the space they occupied led to rather unwieldy drawings, both cumbersome to handle and difficult to read.

To meet this situation the principle of the cable system previously described with rather scant favor appeared to be almost the only solution. It was adopted in somewhat modified form, however, in that the leads which left the switchboard proper were drawn into distinctive heavy circles and a system of numbers and letters was devised whereby the function of the wires entering a circle could be readily identified at any point on the diagram where this circle appeared.

The evils of the cable system were also somewhat alleviated by providing that only such leads as were common to the same two points should enter the same circle —there could be no wire leave at some intermediate point. It should be remembered that these circles did not actually represent cables or conduits; they were merely convenient groupings of associated leads all going to the same point, such as a breaker mechanism, on the diagram. The other end of this imaginary conduit appeared as a similar circle likewise identified by the same function letter and number. These function letters, designating, for example, field switch control or potential transformer secondaries, have provided great assistance in rapidly locating the two ends of the lead group and have resulted in all the space-saving advantages of the cable scheme with very few of its drawbacks.

Not perfect, but well founded

While this brief narrative may convey a sense of planned and orderly progress, the part pre-empted by the hand of expediency, while a minor one, has nevertheless not been without some influence. Many promising ideas have had to be abandoned after trial for one reason or another. Those only which survived the merciless onslaughts of internal and external criticism and the growing economic pressure of twentieth-century competition and production managed to persist.

Better diagrams are doubtless possible. Some may be flowering in the leisurely serenity of suburban engineering offices. But, under the twin handicaps of time and expense imposed by the exigencies of modern manufacture, it is felt that the present methods are at least well in the van of a progressive industry suffering under equal disabilities. This does not mean that the unremitting struggle for supremacy should give way to the self-satisfied complacency of a task accomplished, for that way the loss of all such hard-won prestige most surely lies. However, in our efforts toward still greater achievements we have the comforting assurance that our feet are firmly planted and our steps directed along the proper path.

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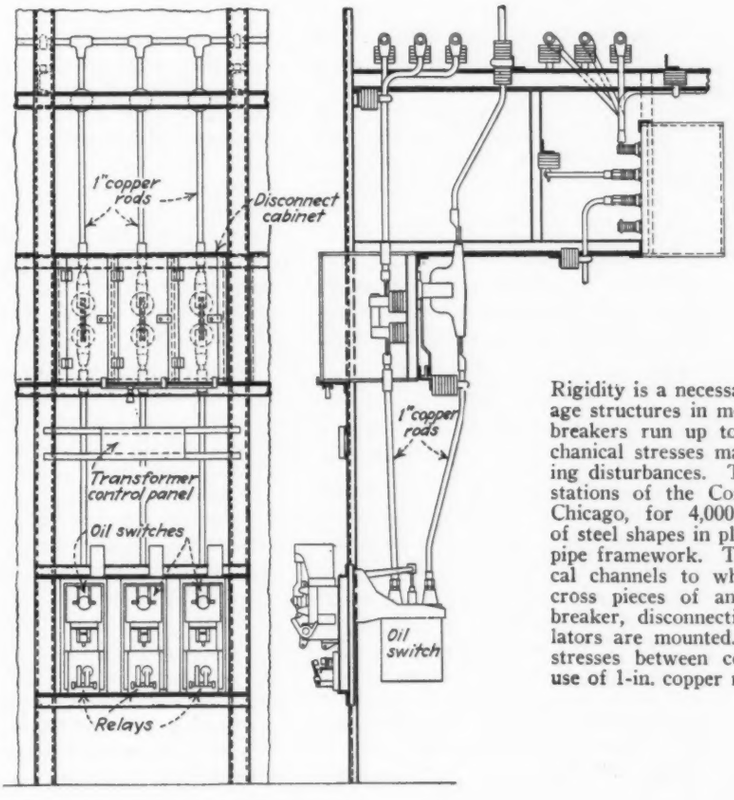


Steel Channels Strengthen Bus and Panel Structure

Rigidity is a necessary element in distribution voltage structures in metropolitan systems where some breakers run up to 1,200 amp. capacity and mechanical stresses may reach very high values during disturbances. This requirement is met in substations of the Commonwealth Edison Company, Chicago, for 4,000-volt construction by the use of steel shapes in place of the more commonly used pipe framework. The frame consists of two vertical channels to which are welded or bolted the cross pieces of angle or channel on which the breaker, disconnecting switch inclosure and insulators are mounted. Additional strength to resist stresses between conductors is furnished by the use of 1-in. copper rod in place of flat bar or cable.

More than 800 Busy Executives Respond to

WITHIN three weeks after distributing the McGraw-Hill "Platform for American Business" 800 frank responses were received from busy executives in various commercial and industrial pursuits. Insurance companies, industrial and commercial organizations, banks, chambers of commerce, architects and constructors, educational institutions, and utilities of all kinds replied. More letters are arriving each day. These executives did not send the familiar one- or two-sentence complimentary or skeptical remarks, as the case might be, but took the time to express quite fully their viewpoints, based on years of experience and study, regarding a universally interesting topic—factors necessary to establish more stable business and employment.

Excerpts from a few of the letters from industrial and commercial executives are presented here, omitting the generalized blanket commendations. Our chief regret is that we cannot identify the writers because any reader would recognize among them men whose prominence and competency would assure acceptance of their opinions. But the delay of securing permission to reproduce their names would retard the public dissemination of the principles they indorse as essential to better business and sociological conditions.

With such responses to show the attitude of progressive business men toward a definite business platform, no community or group need hesitate longer to develop local mechanism or organizations which can serve as the components of a national machine to place business and unemployment on a more stable basis.

Incidentally, anything utilities can do to aid this teamwork will help them augment the good will which they have already merited from their customers and the general public.

Your program represents, in large part, the ———— corporation plan, which was based on the experience of some of the ablest business men and bankers in the United States. If all other businesses would or could follow their example our fundamental business structure would certainly be more stable. —PRESIDENT.

We have been following for the past forty years most of the principles that are outlined, and the depression has had no serious effect on our company. —VICE-PRESIDENT.

In these restless times business has more to do than merely to lift itself out of the present depression. The problem goes deeper than that. Its fundamentals lie in the root-causes of this and other depression periods. They are as much concerned with the dangerously exaggerated upward swings of the pendulum as they are with the blighting-downward sweeps which inevitably follow. . . .

No swinging pendulum can ever be in static balance. Constantly changing conditions in business, too, will always create temporary maladjustment. And yet the clear recognition of underlying causes and their effects should make it possible to bring to bear equalizing forces which will automatically tend to check the high side and give buoyancy to the low side, thus holding the path of the pendulum within reasonable limits. —PRESIDENT.

✦

Interdependence of nations and of capital and labor must be recognized and demonstrated. Must remove feeling of insecurity of labor.

Our foreign markets are going to play a continually larger part in the employment of our people and in our prosperity. —PRESIDENT.

We are so dependent on our trade relations with all other civilized countries that I fear we cannot be prosperous unless the rest are.—PRESIDENT.

In spite of the benefits to be derived from the ideas and plans outlined, I do not feel that it gets to the real root of the most serious condition which must be corrected before we ever get back to anything like a normal situation. I refer to unemployment. . . .

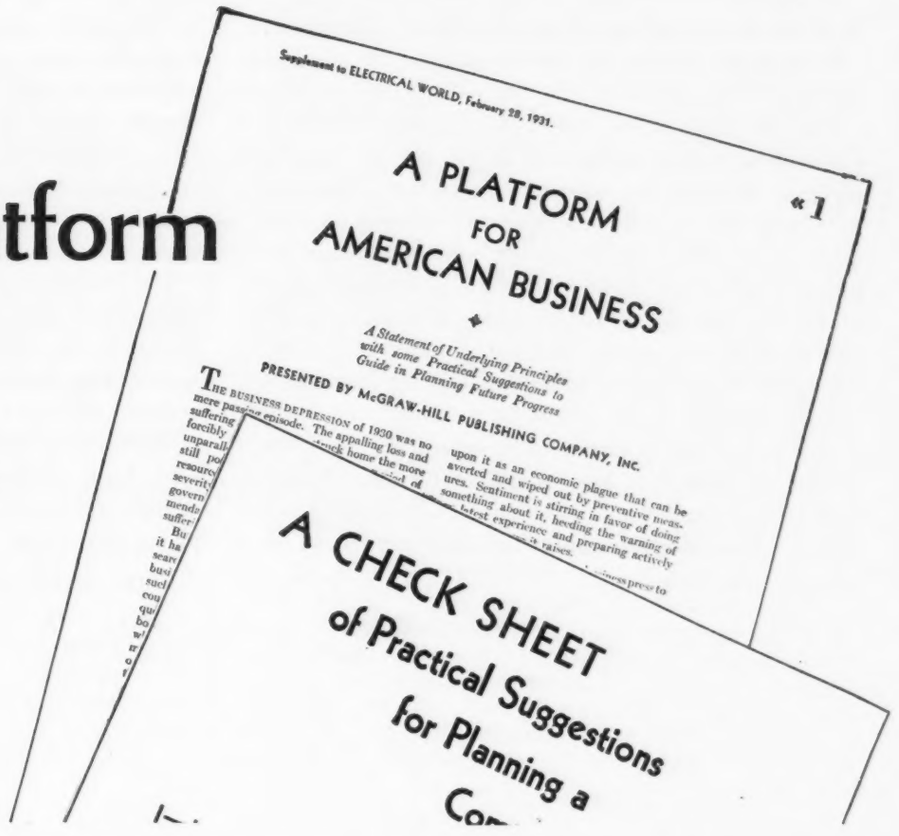
Many of those who have employment are living in a state of constant fear that they will lose their jobs any time. This adds to the difficulties of making sales of products and carrying on business in anything like a normal way. . . .

Business firms could help the situation materially if they would take the time and trouble to attempt to divide their work among a larger number of people, even though some of those now employed would have to accept a reduced income. —VICE-PRESIDENT.

Policies such as you suggest not only do more to stabilize industry and eliminate both peaks and dips, but also offer the best weapons with which to combat industrial unrest which has developed in its most dangerous form in Soviet Russia. Management is awakening to the fact that during slow periods there is an obligation to the employees as well as the stockholders. —VICE-PRESIDENT.

I have no hesitancy in indorsing all the recommendations which you make, but I am not convinced that the prosperity of the United States is dependent, to any marked degree, on our international relations. —PRESIDENT.

Business Platform


Supplement to ELECTRICAL WORLD, February 28, 1931.
A PLATFORM FOR AMERICAN BUSINESS
A Statement of Underlying Principles with some Practical Suggestions to Guide in Planning Future Progress
PRESENTED BY McGRAW-HILL PUBLISHING COMPANY, INC.
A CHECK SHEET of Practical Suggestions for Planning a

Leadership or the ability to project oneself into the future and adapt policies and practices thereto is sorely needed. Business must reform itself or government will. Individual initiative must be maintained, but rules of conduct are necessary.

Undoubtedly something will have to be done in the new era just ahead about controlling production, policy and prices unless we are to have a repetition of what we are now going through.

It would be much better for this control to come from within industry itself than from the government, but as I understand it this is almost impossible under our present laws.

—PRESIDENT.

If our great fundamental industries can be allowed to make a reasonable profit, keeping alive the competitive system but holding it within bounds, a long step would be taken toward avoiding booms. —PRESIDENT.

Business must expect to be regulated by government legislation if it will not set up within its own groups proper rules of procedure governing the conduct of those units in the group toward the public, their employees, their stockholders and the individuals representing the separate managements.

With the tendency to conduct business in larger units the problem of preserving initiative and incentives on the part of employees is very important.

—PRESIDENT.

I think you would improve your plan by including a definite statement that modern industrial organization, with its infinite division of labor and many-sided interdependence of one upon another, requires for its smooth operation a type of individual who recognizes the economic facts and acts accordingly within closer limits than were required under the conditions of lesser interdependence which existed a short time ago. —PRESIDENT.

When we realize the thousands of years that the individual has developed as an individual, it is not surprising that it is hard for him to recognize the necessity for his acting with a group and considering not alone his individual needs but the needs of the group.

Only courageous and intelligent leadership by those with proper vision and training can bring about an improvement in the situation.

—PRESIDENT.

One of the outstanding reasons why America has grown since the Civil War has been the individual initiative of its citizens, I am wondering whether the unconscious tendency to stifle initiative through large corporate organizations may not be more fundamentally the cause of our troubles than we think. —PRESIDENT.

American business needs enlightened leadership and salutary objectives, more than ever before, if it is to escape additional permanent burdens growing out of the conditions of the past several years. —PRESIDENT.

If your program is to have any chance of success, it is essential that it have the enthusiastic backing of the great majority of business men.

About the only chance of accomplishing any results along this line is to take up one or two specific points at a time and to concentrate on them. —PRESIDENT.

The real solution must be looked for in industry and business rather than from the government.

—PRESIDENT.

Unless big business undertakes the solution of some of the social problems that attach to industry and which have recently assumed very serious importance, legislation will be enacted that will prove to be both expensive and annoying. —PRESIDENT.

✦

Political and government intrusion into business has retarded business recovery. Existing and future laws should not restrict fair co-operation in business. Non-taxable reserves for unemployment recommended.

As long as American business men hold aloof from public affairs and tolerate the low order of ability that characterizes the average public official and representative—whether he be state or national legislator—there is little hope of making certain worthwhile objectives embodied in your platform more than a dream.

—PRESIDENT AND GENERAL MANAGER.

Let us have less government in business by all means. Let us, also, obviate the necessity for legislative fiats by correcting such trade abuses as do exist. —PRESIDENT.

The business world should be made to realize that its acquiescence to inefficiency and graft in governmental operations is placing a heavy toll on the economic structure of the nation.

—PRESIDENT.

YOU are leaving out of consideration one important element, perhaps the most important of all, and that is human nature.

Our business cycles cannot be eliminated because business is being conducted by human beings and our progress depends on individual enterprise. One has only to reflect on what has happened to reach the conclusion that "individual enterprise" and "individual initiative" are merely polite terms for acquisitiveness, and that as long as acquisitiveness, to say nothing of greed and cupidity, is inherent in human nature and is the strongest motive power in our system of social economics, excesses simply cannot be avoided.

It is not in human nature to be content to "sit lower down" permanently. Men would rather take chances than accept a sure thing. One cannot win without risk of loss. Remove the chance of winning and individual enterprise is dead. . . .

Our efforts should be to keep the swings within reasonable limits so that no class of society reaches a condition of real distress. But better far the much-dreaded valleys of our business cycles than the *dead* level of trade controlled by government, either directly or through federal banking arrangements. The real problem of control which is before our business leaders is that of self-control.

The present depression constitutes a serious indictment of our executives and of the stockholders who hire them. In the mad scramble just past every one seems to have been forced by the example of every one else to abandon the use of old-fashioned homely virtues such as self-restraint and consideration for others. On the other hand, the manner in which we shall climb out of our present predicament may turn out to be a tribute to the real merit and ability of those same executives.

—VICE-PRESIDENT.

With the many bills now before our state and federal Legislature it is going to be necessary for the manufacturers to present their side of the case or some of these bills will be passed which will be very detrimental to the American manufacturer.

—GENERAL SALES MANAGER.

Would it not be an opportune time to suggest to Congress enactment of legislation which would permit business to set up reserves against unemployment and regard it as a legitimate reserve and not taxable income?

—PRESIDENT.

✦

Mechanism for carrying out a program is needed.

Unless there is one centralized control of all economic forces, I cannot see how we can expect to maintain a perfect balance in the economic system.

—PRESIDENT.

Problem is to get these policies into effect. —PRESIDENT.

I am very much in sympathy with your purpose, but I *do* think that it is more important for you to find the machinery with which to carry out your suggestions rather than merely to broadcast the suggestions and let the seed fall on either barren or fertile soil as fate dictates.

—CONTROLLER.

Business should be impressed with the responsibility of aiding in the development of more strictly local resources as well as aiding in the development of the resources of a wider field or of the nation as a whole.

—SECRETARY.

The American business man needs education. The question is how to make him take it. —PRESIDENT.

While the principles laid down are intrinsically sound, the development of a method or a system of carrying out such a program is quite another matter, and naturally will take a great deal of thought and a great deal of time for their development. . . .

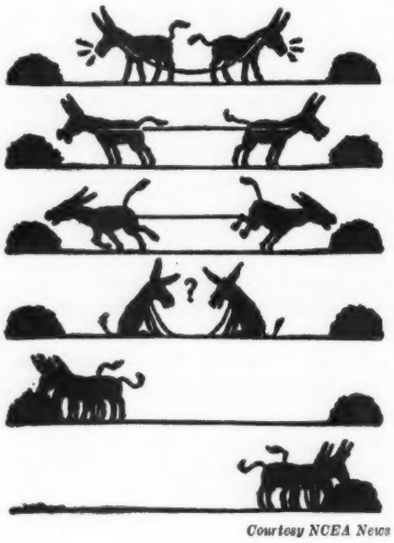
If a business organization, or an individual, has been subject for a number of years to a constantly increasing demand for its product, it may fail to interpret facts which may be produced by the industry in the same way that it interprets these facts if a reverse condition has existed in industry for a number of years.

—PRESIDENT.

To sell it (the Business Platform) in a national sense it is important that it be understood and that its significance be appreciated by those centers of influence which see the social responsibilities of business as well as the economic responsibilities of business.

There are three opinion-forming agencies which would help to organize opinion: Trade association secretaries, social workers and business paper editors as a group.

—MANAGING DIRECTOR.



Courtesy NCEA News

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Market analyses, statistics on demand as well as production, sales development that will excel production, foreign market policy and long-term planning essential.

Of what avail is it to plow money into business either in the form of undivided profits or new capital when a given market has not sufficient ultimate consuming capacity to keep things moving?

When we plow a dollar into production, we must also spend enough money in sales development to use up production. —PRESIDENT.

The United States Census Bureau spends much time and money in collecting information on production. Much of this information is anticipated by up-to-date trade associations. If the bureau would take equal pains to inform the people as to distribution and consumption, the knowledge thus obtainable would have a marked influence in the direction and limitation of overproduction and of waste in attempted distribution. —PRESIDENT.

Require business management to think in terms of long-time planning where financial assistance is provided, particularly with reference to keeping production in line with sales.

—TREASURER.

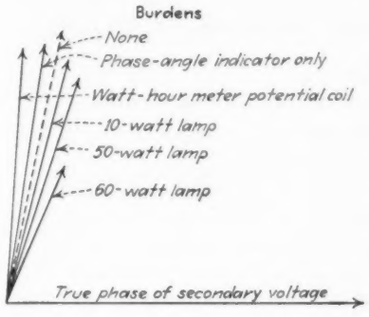
It is doubtful whether the average industrial concern could justifiably charge to capital account amounts of money spent for research. I rather favor the principle of paying as you go. —PRESIDENT.

Checking Meters for Blown Transformer Fuses

By S. A. FLETCHER

Commonwealth & Southern Corporation, Birmingham, Ala.

In high-tension metering, such as 44,000 volts and above, the condition of a blown potential transformer fuse or even an open circuit in the primary winding itself is not readily disclosed, because even with an absolute open circuit in the primary there will be some voltage shown across the secondary. This may seem strange at first, but it must be realized that the high-tension winding in proximity to the secondary and the core will act as a condenser, and consequently a charging current will flow in the primary. This current will be sufficient to set up voltage in the secondary which will be much greater than might be anticipated. Its value will depend upon the secondary burden of the potential transformer as well as somewhat upon the design of the transformer. A 200-volt-ampere, 44,000/110-volt-potential transformer was recently tested and under these conditions the secondary voltage ranged from 85 with no burden down to 10 with a 0.7-amp. burden. The normal voltage was 107.



Open fuse or potential transformer gives queer secondary voltages

Charging current acts as exciting current to induce spurious voltages in secondary. A 400/1 transformer gave 75 volts with nearly 90 deg. shift in phase when burden was watt-hour meter potential coil.

At 0.1 amp., the normal value of the current taken by one potential coil, the voltage induced in the secondary with one primary fuse open was 75 volts. This is enough to cause the indicating lamp in the meter to glow and also to make the meter rotate if there is load on at the time. Hence it is necessary to use a voltmeter to detect the presence of this trouble. Any such serious drop in voltage as shown in this case would call for an immediate investigation to determine the cause. It is, therefore, recommended that all tests of high-tension meters include a check of all phase voltages. Such has been the practice for several years of the company of which the writer was meter superintendent for an extended period.

The phase position of this voltage is also seriously wrong; in fact, it is almost 90 deg. ahead of where it should be. The larger the resistance burden the less the phase shift, but with the inductive potential coil alone there was found to be 84 deg. between the normal voltage and the abnormal voltage.

This phase-angle shift has a marked effect upon the meter registration. Take as an example a load with a lagging current of 30 deg.; that is, with a power factor of 86.6 per cent. Under these conditions the meter will operate normally with the current and voltage in phase on one element and 60 deg. apart on the other element. If the transformer operating the first element is the one which fails, then not only will the voltage be reduced to approximately 75, or about 30 per cent reduction, but the phase angle between the current and voltage will change from 0 to 84 deg., hence the meter will run at a very much reduced speed. If it were the voltage on the other element which failed there would be a similar drop of 30 per cent, but the phase angle, which was 60 deg., becomes 60 deg. $-$ 84 deg. $=$ $-$ 24 deg., or a lead of 24 deg. Now the cosine of 60 deg. $=$ 0.50, while the cosine of 24 deg. $=$ 0.91. Hence the torque of this element normally is proportional to the voltage and the cosine of the phase angle or $107 \times 0.5 = 53.5$. Subsequent to the open circuit the torque becomes proportional to the new voltage and the new cosine, or $75 \times 0.91 = 68.25$. This is an increase of nearly 28 per cent in this element and the meter in consequence will run too fast by approximately 9 per cent.

With lower load power factor the final result on the meter would have shown an even greater increase in registration. For instance, at 70.7 power factor the slowed element would operate at 9 deg. phase angle instead of 75 deg. This will result in the meter, as a whole, operating approximately 35 per cent too fast.

To meet this situation our meter testers carry a phantom load in which is incorporated a voltmeter and an ammeter, both of small size, which are used to check the balance of current and correctness of the secondary voltage of all power-metering installations.

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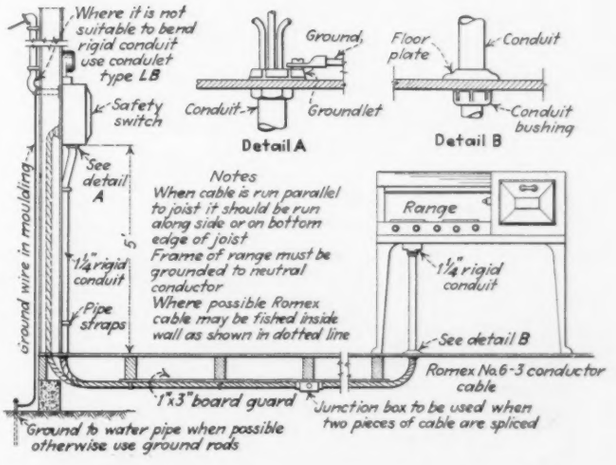
Standard Range Service


Where it is not suitable to bend rigid conduit use condulet type LB
Safety switch
Ground
Floor plate
Conduit
Conduit
Groundlet
Conduit bushing
Detail A
Detail B
See detail A
Notes
When cable is run parallel to joist it should be run along side or on bottom edge of joist
Frame of range must be grounded to neutral conductor
Where possible Romex cable may be fished inside wall as shown in dotted line
Range
ground wire in moulding
5'
1¼" rigid conduit
Pipe straps
1¼" rigid conduit
See detail B
Romex No.6-3 conductor cable
1"x3" board guard
Junction box to be used when two pieces of cable are spliced
Ground to water pipe when possible otherwise use ground rods

Range wiring at an average cost as low as $30 per installation is stated by the Central Power & Light Company to be reached by this layout. The company, in spite of the fact that 1,000 B.t.u. natural gas at rates of from 40 to 60 cents per thousand cubic feet offers powerful competition, manages to sell between 700 and 800 ranges annually to its 36,000 customers in southwestern Texas. Naturally the selling is not on a price basis, but purely on the convenience, cleanliness and superior results of electric cooking.

European Hydro Practice Through American Eyes

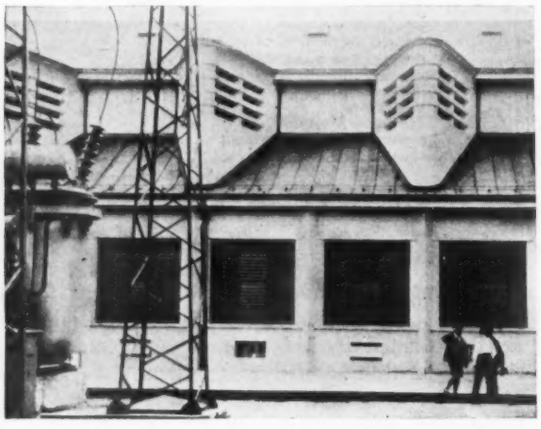
By L. F. HARZA

Harza Engineering Company, Chicago, Ill.

One of our country's foremost hydraulic engineers goes to Europe with a blank notebook in his hand. He comes back with the notebook filled with information. "Electrical World" prints excerpts from it in this article, offering significant comments on the differences between our practices and those of the old world

FROM observations of stations built and in construction and of laboratory research now in hand, made in Germany, Austria, and Switzerland during the summer of 1930, one can say that Europe has done and is doing high-class technical engineering as well as some significant pioneering in the hydro-electric art. One thing that claims notice from the American visitor is the great amount of laboratory research on the general problem of hydro power, a conspicuous example being the cavitation laboratories and their experiments performed in connection with all-important developments. In stations built and in construction one notes the great sizes and extensive application of the Kaplan turbine with governor-adjusted blades. Another feature is the growing use of the principles of hydraulic storage of off-peak steam and surplus hydro energy by pumping and subsequent regeneration. Germany, for example, now has in operation about 750,000 hp. in pumping and regenerating capacity.

In the details of design, construction and operation are a number of noteworthy features. Among these are the general use of spherical valves for pipe line units, under medium and higher heads; double-leaf spillway gates, permitting overflow or underflow; trash rack rakes, stainless steel runners, divergent practices in the design of thrust bearings, ventilation provisions and switchboard features. Relatively slow progress in construction invites the attention of the American observer.



Intake and discharge louvers for ventilating generators

Achensee development, in Austria

There are many hydraulic laboratories in Europe, some 35 in all on the Freeman scholar visiting list, but it is deemed sufficient for the purpose of this article merely to indicate the type of research in the four that were visited. In the "Flussbaulaboratorium" of Professor Th. Rehbock, at the Karlsruhe Technische Hochschule, were studies in progress on river erosion, deposition, weirs, dams, gates and other river problems. In Professor Thoma's laboratory at the Technische Hochscule at Munich were noted experiments on turbines and pump cavitation and related mechanical and hydraulic problems. Similar investigations were observed in the laboratory of the J. M. Voith Company at Heidenheim. In the laboratory of the Forschungsinstituts für Wasserbau and Wasserkraft in the Alps at Obernach, about 50 miles south of Munich and near the forebay of the Walchensee plant, were studies devoted to a comparison of accuracy of the several methods of measuring water.

Land is too expensive and valuable in fertile valleys to permit flooding except in the mountains. Therefore, many of the rivers are developed by parallel power canals diverting from the river and following close to the side slopes of the valley, with occasional hydro plants to use the fall. A similar river in the United States would probably be developed by dams flooding the valley, but it is easy to understand why this is not done in Germany when one sees the intensive cultivation of the soil and appreciates the importance of utilizing every acre of available agricultural land.

Two important German projects are being built on a

Canal for water measurement

In the rectangular concrete flume of the Forschungsinstituts für Wasserbau and Wasserkraft, at Obernach, (2 m. wide, 2.5 m. deep) water is being measured simultaneously by all available methods, including weirs, salt titration, salt velocity and current meters.

four-year construction program. This is a very slow schedule indeed, and no American plant of equivalent size would require more than two years in building. It is believed that the engineering, design and construction of projects in Europe are carried on much more slowly and deliberately than in the United States. In the first place, the loads to be served do not grow rapidly and force construction at high pressure in order to meet the demands for energy. Furthermore, it is believed that the European psychology does not permit quality to be sacrificed for the sake of speed to the same degree as in this country, and it is probably recognized that the American saving of interest during construction is frequently more than offset by the excess cost and waste of high-pressure work. Construction equipment cost is the bugaboo of American contracting, which could be greatly reduced by slower construction, especially in a country with relatively low labor costs.

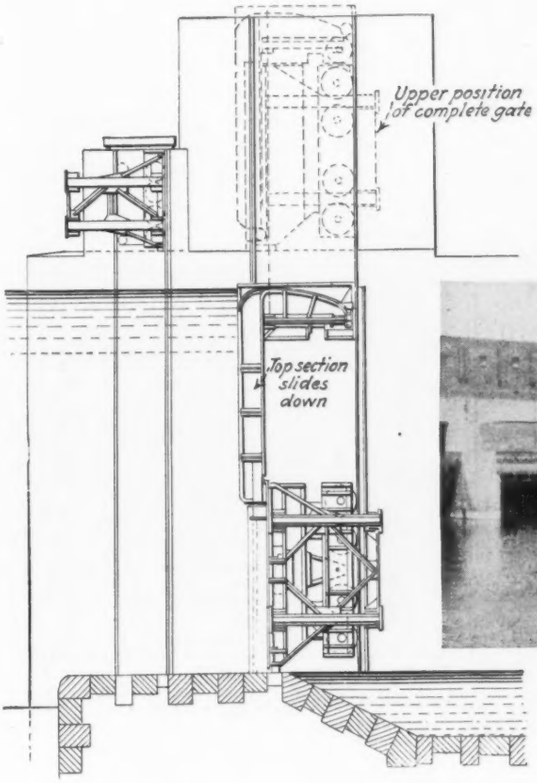
Floodgates in Europe seem to take a more elaborate form than in this country in general. Simple truck gates, stony gates and tainter gates, so much in use here, are seldom in evidence there. Instead we find cylindrical or roller gates, designed to raise or lower, telescoping double-leaf sluicegates of several designs, permitting overflow or underflow (guillotine gates), Stauwerke balanced gates, bear-trap, bascule, submerging sector gates, floating gates, etc.

The only one of the long canals visited was the Isar and this at each point observed was concrete lined about 6 in. thick and the inside slopes stated to be one to one. The lining is placed without inside forms, being merely packed in place dry enough so that it will stand.

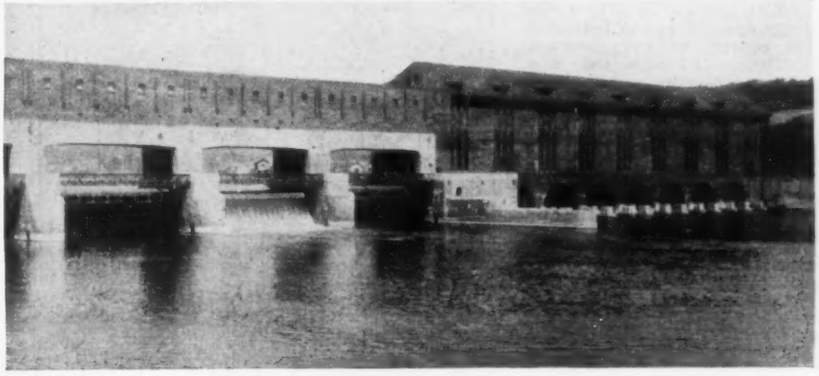
Nothing remarkable was observed in connection with intakes except the more frequent use of mechanical trash rack rakes. Intake gate hoists frequently consist of hydraulic cylinders, with oil or water pressure, and of motor-driven geared design, driving wire rope drums.

Penstock construction, in general, is similar to our own. They build of riveted and welded construction for lower heads with all of the several forms that we use, and for higher heads, hammer welded, electric welded, ferrum banded, forged, etc., are used.

It was very interesting to note the diversity in methods



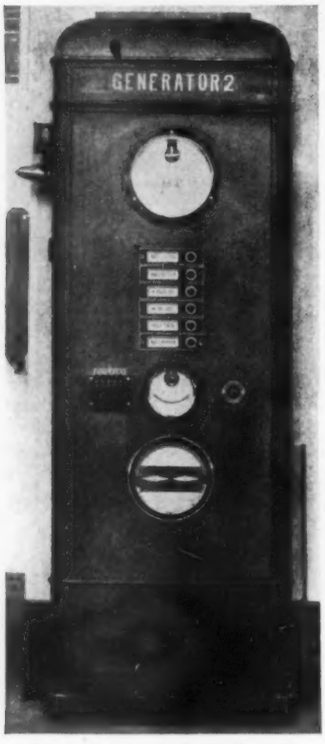
Guillotine gate copes with flood flow



The double-leaf floodgate at Kachlet on the Danube is about 40 ft. high and 82 ft. long. Upper gate slides down onto lower gate like a shear, or guillotine. Trash and ice in the head pond may be cleared off without great waste of water by a slight lowering of the crest. Hoisting equipment is inclosed in an overhead house.

of supporting penstock lines. For example, at the Niederwartha pumped storage plant the penstocks are supported at intervals of 52½ ft., a much greater support distance than we use for equivalent pipe 9 ft. 9 in. diameter and ⅜ in thickness. The supports are machined rollers on planed iron castings on concrete foundation. On the other hand, at the Aufkirchen plant, on the Isar Canal, pivoted rockers are provided instead of rollers. In other plants no precautions are taken for rolling or rocking supports, but penstocks are merely cast into concrete saddles, as is often done in this country, it being necessary for the pipe to slide in the saddle.

Valve practice ahead of the turbine differs somewhat from our own. Hydraulically balanced valves, such as Larner-Johnson, were not observed. Heavy gate valves were noted but rarely, occasional butterfly valves under low heads, but the prevailing type of valve is the spherical. In principle this is merely a sphere with a hole through it, a glorified petcock mounted on a heavy axis for rotation like a butterfly valve. The advantage of this valve is a perfectly smooth uniform pipe section free from obstructions when the valve is opened. The equivalent in this country is the cone valve.



Elaborate air control

One such stand is provided for each of the eight units in the Kachlet station and is exclusively devoted to the indication and control of the generator ventilation through the duct system, indicating temperatures —incoming, outgoing, proportion of air coming from outdoors and indoors, etc.

European turbine practice presents several departures from our own. Most important is probably the fact that the Kaplan turbine with governor-adjusted blades has become almost standard for European low-head development below 50 or 60 ft. One project under construction will have four of these units of about 35,000 hp. each, operating under 38 ft. head with about 23 ft. throat diameter. Units a few inches larger are now being built for Russian use by a Swedish concern. The Germans and Swiss build the Kaplan blade operating cylinder or servomotor into the shaft between the turbine and generator. The Swedes formerly mounted it on top of the generator, but now build it into the turbine hub.

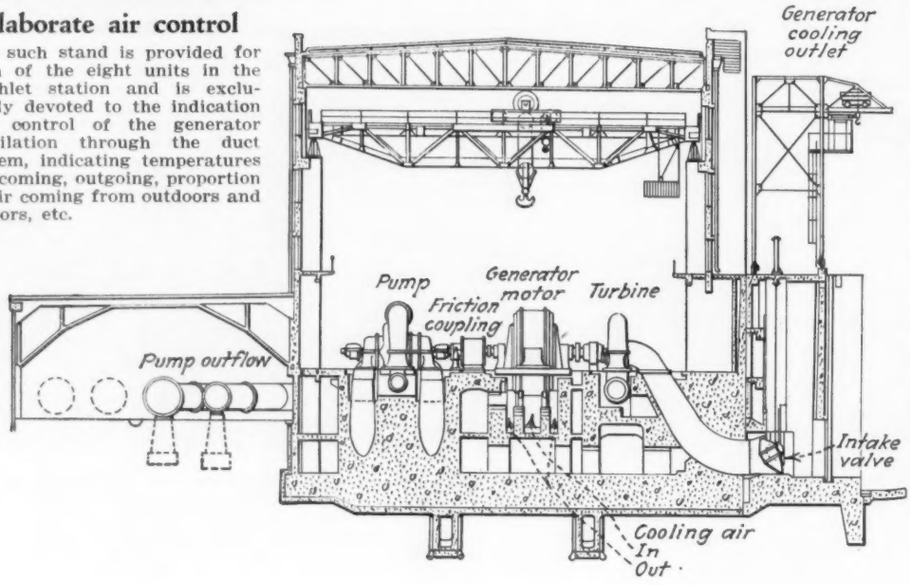
It seems to have become universal practice in Europe to machine all propeller blades, fixed or movable. It is claimed that pitting starts with an initial unevenness of surface or roughness and progresses much more rapidly than on a finished surface. Other reasons claimed for machining are definite and exactly identical shapes of blades, eliminating hydraulic unbalance and giving higher efficiency.

In regard to Francis turbines, there is not believed to be important differences between American and European practice. Stainless steel seal rings and runners appear to be growing in favor. The Ateliers des Charmilles is building turbines of the Francis and propeller types with inclined or conical regulating gates; that is, with axes not parallel, but converging toward the top. They claim greater capacity and therefore greater specific speed for this design.

In several places provision is made for forcing down the water in the turbine by compressed air during periods of high tailwater to permit the unit to run as a synchronous condenser.

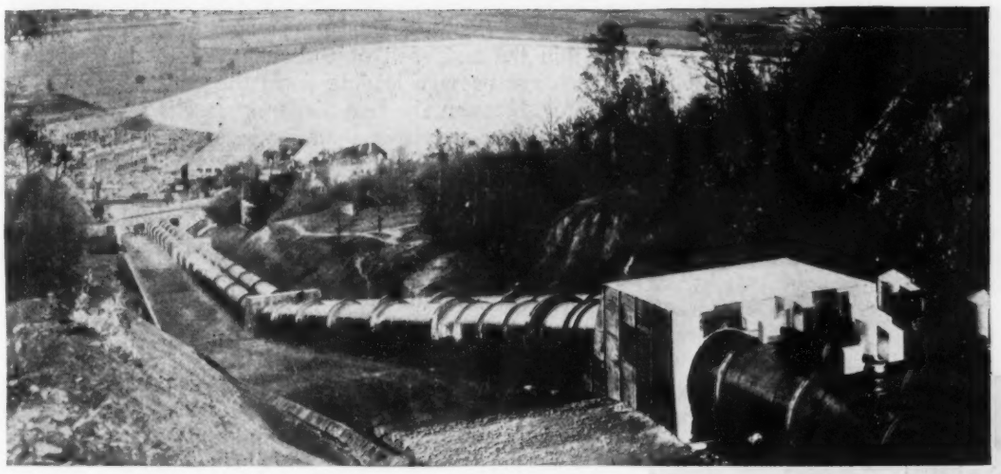
In high-head Francis turbines the Ateliers des Charmilles is now building three bronze runner units each of 35,000 hp. capacity under 1,050 ft. head, probably the highest head to which a Francis turbine has ever been applied. The same company has built several Pelton machines for about 3,280 ft. head. Its practice in Pelton wheels is to cast the whole rotor, including buckets, in one integral steel casting, and then grind out the bucket surfaces afterward, instead of attaching the buckets to the rim by bolts. The Fully Pelton wheel plant, 5,000 ft. head, in Switzerland was inspected.

Governors appeared in general to be much heavier than

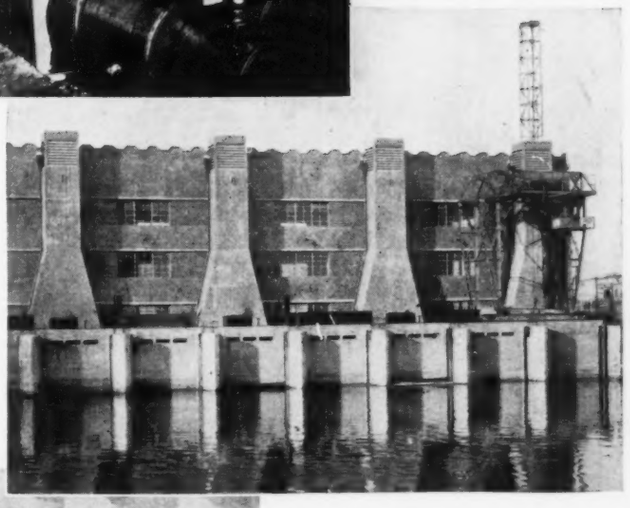


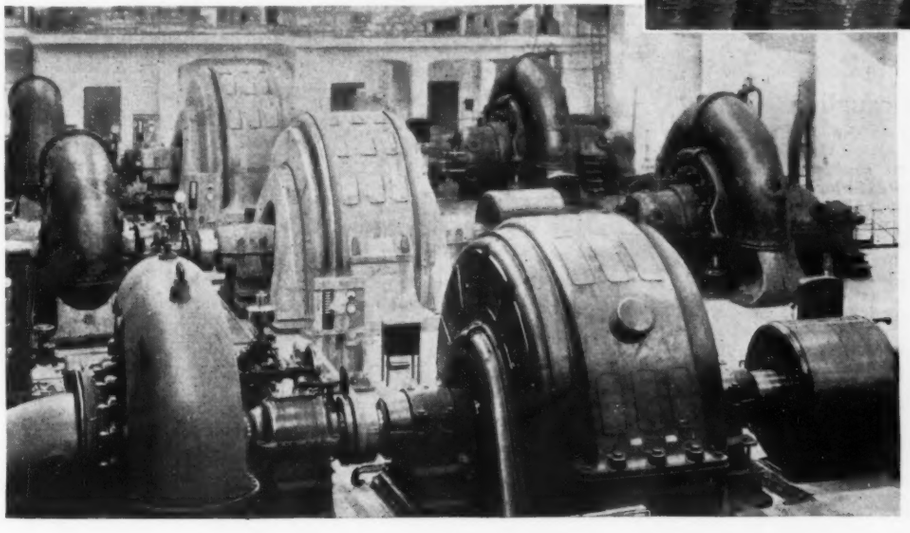
Regenerative cycle used extensively

Most of the regenerating plants, such as Niederwartha, a section of which is shown, and Herdecke, use horizontal units with a pump on one end, turbine on the other end, and a generator motor in the middle. Recently vertical units have also been introduced having a motor generator at the top of the shaft, with turbine, coupling and pump below in order named. Surplus hydro energy and off-peak steam energy are used for pumping, thus permitting the steam plants to run with almost 100 per cent load factor. On peak load hours the pump is disconnected and the turbine is operated on the water stored during off-peak hours, using the electrical unit as a generator.



Features of Niederwartha Station, near Dresden





This regenerative station now contains four 21,500-kva. turbine-generator-pump units, a total of 86,000 kva., which is one-half the ultimate capacity. Generation is at 10,000 volts. The small amount of make-up water to compensate for evaporation comes from the River Elbe, near by. The exterior view shows the ventilating chimneys for generator cooling air.

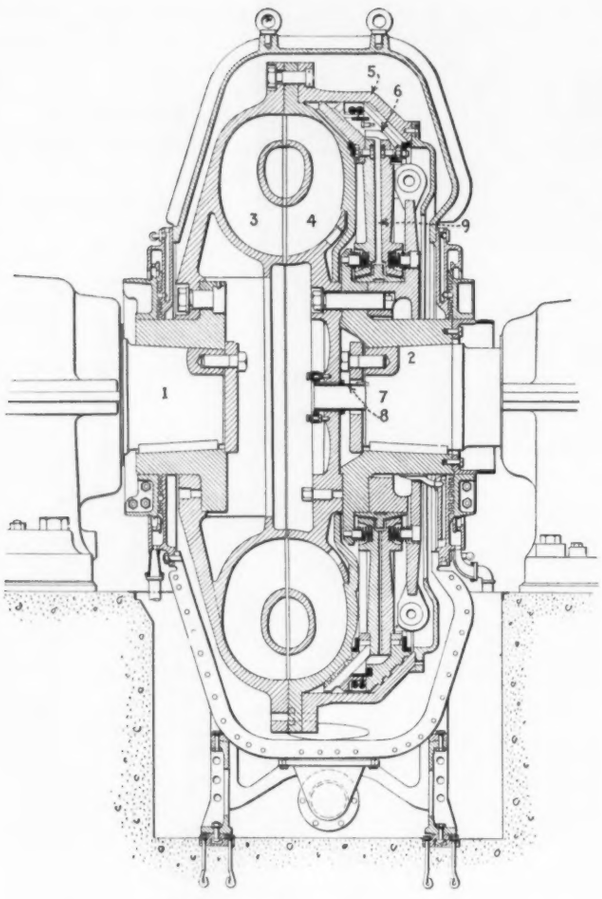
American governors, with much more elaborate connections to the turbine, especially in the case of vertical units. No installations were observed with the simple American design using two oil pressure cylinders with pistons operating tangentially on the shift ring through connecting rods.

Some important thrust bearings were found to simulate the principle of the Kingsbury bearings (known in Europe as the Mitchell bearing) by using a rigid plate instead of pivoted shoes, with this plate so ground as to provide variable clearances, approximately that of the assembly of Kingsbury shoe surfaces when in operation. This is believed to be similar to the principle of the Gibbs bearing in the United States.

The most interesting thrust bearing, however, is that offered by the Ateliers des Charmilles. It is a Kingsbury or Mitchell bearing, with the steel shoes cast integral with an annular base and supported from this base by cast-steel pedestals eccentrically placed under the shoes. The position and stiffness of these pedestals have been designed by experiments to yield the same deflection to the shoe as in the pivoted design. They then key a cast-iron polished plate onto these shoes for a bearing surface, thus giving a cast-iron to cast-iron friction. Furthermore, this company has increased bearing pressures with this design to a standard average value of 600 to 900 lb. per square inch and are experimenting with 4,000 lb. per square inch, as compared with usual American practice of about 300 to 400 lb. per square inch.

European generators are generally of cast construction, quite graceful and impressive in design and setting. The less-handsome-appearing welded plate steel machine, which is becoming standard in the United States, was not observed.

The most striking feature was that of ventilation. No plants were observed built within about the last ten years



Novel hydraulic coupling

Fastened to the motor shaft (1) is the driving member (3), inside which are impeller blades. Facing the latter is member (4), fitted with turbine blades. Member (3) is carried around (4) to form the exterior plate (5) of a friction clutch whose interior plate (6) is carried on the member (4). Water is admitted to the annular chamber formed through the hole (7). The impeller blades in (3) build up a pressure in the water and through it transmit motion to the turbine blades of (4). By this means the pump is brought up to about 95 per cent of the motor speed. When this has been attained port (8) opens, admitting water between plates (9), which are forced apart by the centrifugal water pressure. Movement of the plates brings the interior (6) and exterior (5) cone clutch surfaces together, completing the coupling engagement with no slip between its driving and driven parts. By the use of this Foettinger coupling it is possible to convert the electrical machine in a regenerative station from a turbine-driven generator into a pump-driving motor without shutdown or loss of synchronous speed.

which discharge the air into the generator room. A completely closed air duct system seems to have become universal, both for vertical and horizontal machines. This is not done by a steel plate drum inclosure, for the normal, graceful lines of the generator are unchanged by this feature.

Often in vertical units the outside shell is merely located far enough out from the stator punchings and coils to accumulate the air and carry it downward between stator and shell to passages leading outward under the floor. In other instances the air is led around in the clearance between stator and shell to discharge duct on one side. Horizontal machines are provided with ducts in the floor and two diaphragm walls underneath the generator with intake air duct dividing around the generator to the two outside passages, and then upward within the end shell of the generator to the rotor, the discharge passage leading from the bottom of the generator, between the two diaphragm walls.

Elaborate means in some stations are provided to indicate and control the ventilating air. One station, Kachlet, indicates on a special control board the temperature of incoming and discharging air and has control buttons for movable curtains to permit any desired proportion of the incoming air to be taken from outside or inside of the building.

Transformer and switching stations

Great variety was observed in these elements of hydro projects. Transformers were often heavily strengthened with an I-beam structure around the exterior. There was no uniformity in practice whatever as between outdoor and indoor substations, and no decided trend could be observed in the latest stations in either direction. The floor of the switchhouse at Pfrombach is elevated above the ground level and the oil switch tanks hang below this floor. The covers are of heavy construction, bolted rigidly to the floor and explosion-proof. Underneath the building is a large depth of coarse screened gravel so that in case of explosion of an oil switch the explosion is all out-of-doors and the oil immediately runs out of sight in the deep gravel bed.

It is realized that the information contained in this article is quite definitely of a sketchy and random character. But exhaustiveness cannot be accomplished in the comparatively brief space available. These random comments are merely expressive of the impressions that remain uppermost in the mind of the visitor after he has returned to his native shores.

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Secondary Cables Studied to Adapt System to Network

By CARL W. EVANS

Underground Distribution Engineer
San Antonio Public Service Company, San Antonio, Tex.

The principal factors affecting the design of a low-voltage network secondary system as compared to secondary systems for "radial feeder and main" and other layouts are (1) the necessity of the network secondary to carry heavy blocks of energy in various areas during a feeder outage in addition to the ordinary service requirements for that particular section; (2) the ability of the secondary to "burn clear" all cable faults, and (3) the requirement of sufficient capacity to allow motor starting without noticeable flickering of lights. In addition to these three factors the designer of the network is usually confronted with a fourth problem, which is to utilize to as great an extent as possible the secondary cable already installed and operating on the old system being converted to network operation without incurring unnecessary expense.

The ultimate design is necessarily a compromise be-

tween the conditions ideal for each factor. For example, the ideal installation satisfying factors one and three above would be large cables closely spaced, giving high current carrying capacity and low inductances, whereas factor two would be most ideally considered if one conductor cable of small size and widely spaced, even in separate ducts if possible, were installed, limiting the possible faults to those occurring between phase conductors and ground and requiring little capacity to burn faults clear. It is evident, of course, that the ideal consideration of the fourth factor would in most cases be the utilization of all secondary cable already installed in the duct system.

To choose one particular type of secondary cable which compromises between all of these requirements would in many cases prove advantageous, since it would simplify records, cable stocks and planning. It has been found in the writer's experience, however, that all four of the controlling factors named do not obtain in the same proportion in all areas of the same network. It has been observed that in certain districts there is sufficient transformer capacity in the immediate vicinity to burn clear faults on much larger than the average size cable. In other areas it is found that large loads at the edges of the network system make the use of low-reactance (multi-conductor) cable imperative if the regular adopted voltage standards are to be maintained. Where multi-conductor cables are used, the conductor sizes must be correspondingly small in order that the cable will burn clear quickly even on phase-to-phase faults.

From experience on the network of the San Antonio Public Service Company it is concluded that for an area of average load density utilizing 300 to 600 kva. transformer capacity per city block three-conductor cables as large as 250,000 circ.mil and one-conductor cables as large as 500,000 circ.mil can be operated without excessive damage at failures. Where transformer vaults are spaced two and three blocks apart the cable sizes should be confined to three-conductor or one-conductor, 250,000 circ.mil.

Seasonal Storage for Northwest

The Ariel hydro development of the Inland Power & Light Company, which is about 32 miles northeast of Portland, Ore., on the north fork of the Lewis River, is expected to be in operation about September, 1931, just 22 months after construction started. This development will provide the first seasonal storage of water for power in the Portland district—220,000 acre-feet. The head on the plant will be 185 ft. with the reservoir full. Although foundations have been provided for four units, only one 45,000-kw. unit is being installed now in a building that will accommodate two units.

The single-arch variable-radius dam at Ariel has a maximum height of 313 ft. owing to a deep cut in the rock formation in the river channel, which had to be refilled with gravel. Total length of the dam and spillway is 1,400 ft.; spillway is designed for 100,000 sec.-ft.

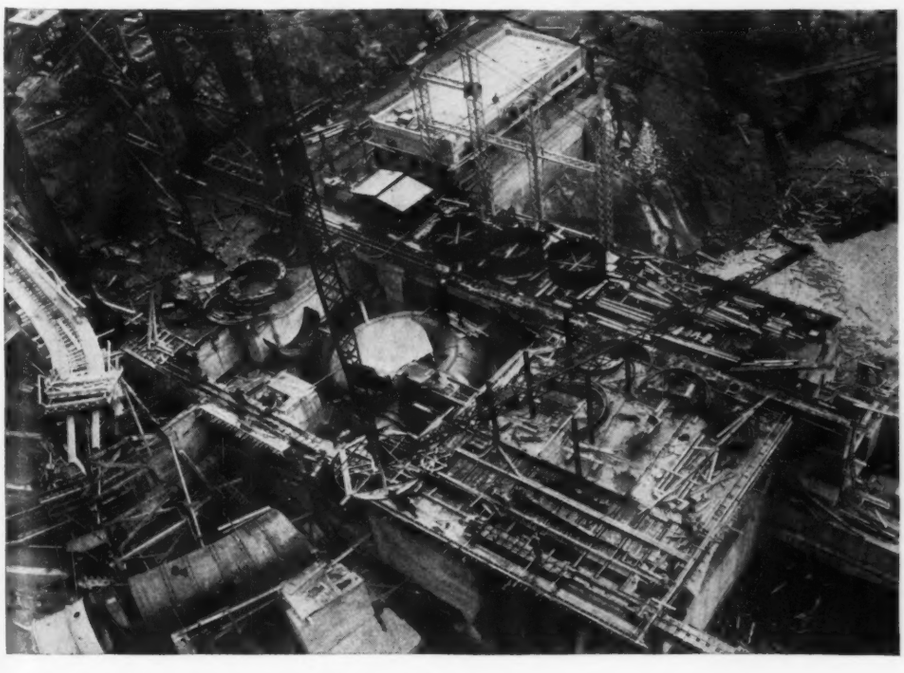
Generators and auxiliary apparatus will be inclosed in a small low building, over which will operate a 250-ton outdoor gantry crane, the bridge of which cantilevers over the tailrace side for handling the transformers, located on a downstream extension of the substructure.

No low-tension bus or switching is provided, each generator and its corresponding transformers constituting a unit. The 110-kv. leads from each unit will be connected to a switching station on the transmission line from Vancouver to Kalama, Wash., which is owned by the Pacific Power & Light Company but leased to and operated by the Northwestern Electric Company. All switching will be done on the 110-kv. bus in this outdoor switching station.

Calculations indicate that with 60-ft. draw-down on the storage provided, about 25,000,000 kw.-hr. could be generated annually. Reports indicate that the reservoir will be about 12 miles long, 1½ miles wide at its maximum and have a surface area of about 4,000 acres.

The river which feeds this reservoir is a glacial stream that carries about one-third the run-off of Mount Adams and one-half that of Mount St. Helens. According to records available, the maximum flow is 60,000 sec.-ft. and its regulated flow about 5,600 sec.-ft.

Northwestern Electric Company's transmission system is interconnected with the Pacific Power & Light Company, Pacific Northwest Public Service Company and Puget Sound Power & Light Company.

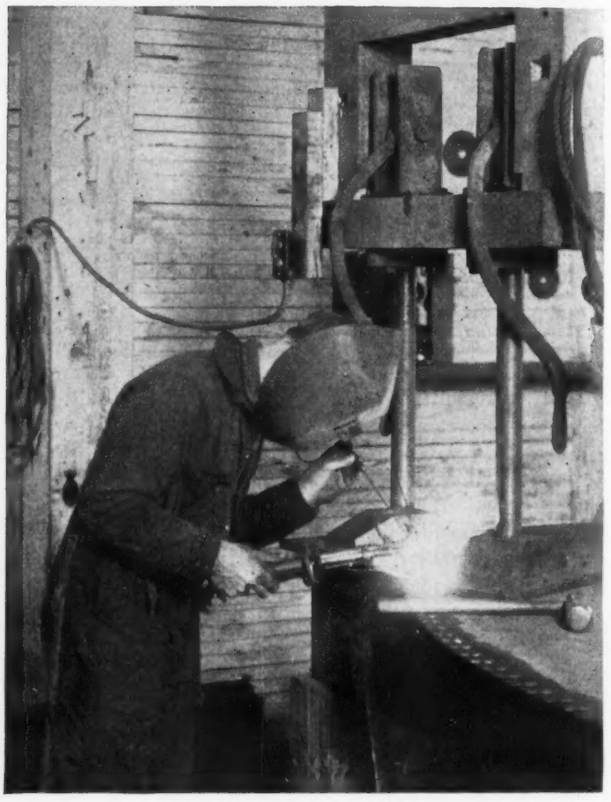


Construction at Ariel on the Lewis River, Oregon
(As of February 14, 1931)

Electric Saw Repairs Reduce Costs in Lumber Industry

OUT in the Pacific Northwest, where lumbering is a man-sized job, saw manufacturers are not just around the corner, new saw inventories must be kept down, unnecessary replacements are to be avoided and over-all expenses are, as everywhere else, rigidly kept to true economy bases. Here electric atomic hydrogen welding is doing a hard repair job well.

The Vance Scales Saw Welding Company of Tacoma, Wash., is engaged exclusively in the repair of band, circular and other large saws, saving many dollars for the industry.

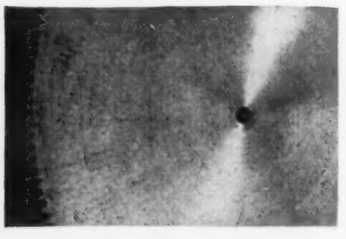


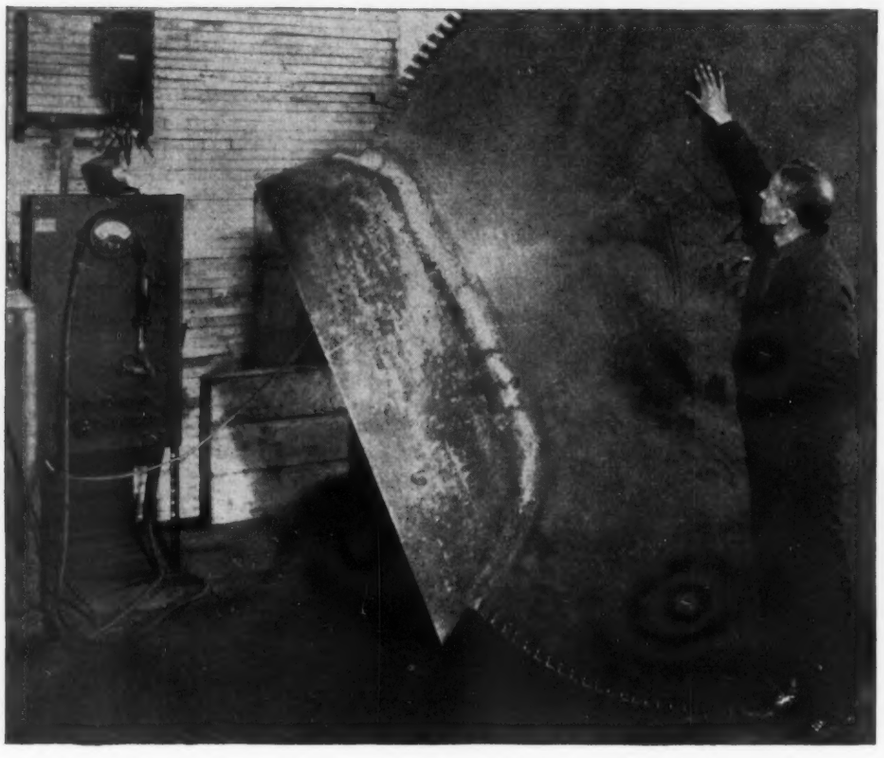
Setting a new section in a 108-in. circular saw by atomic hydrogen welding

(Before)

Center failures no bar to repairs. These two (before and after) views of the same saw illustrate character of repairs. This saw had been repaired unsuccessfully by another method before atomic hydrogen-welding solved the problem

(After)





Photos Courtesy General Electric Company

Tests show strength of welded saws to be equal to that of new ones. Section inserted by atomic hydrogen welding requires cutting of new teeth slots and welding-in of new teeth before returning to service

Urges Large Lamps in Modern Illumination

By M. M. SAMUELS

The J. G. White Engineering Corporation, New York

FOR many years the principal drawbacks to the modern ideas in lighting were two claims persistently made by even the best of fixture designers —first, that an artistic illuminating body cannot be designed without the employment of the candle idea, and, second, that it cannot be done without the use of the so-called "round" bulb. When modern ideas first began to filter into this country from France and Germany it was strongly emphasized[1] that fixture designers must get away entirely from the idea of copying the blacksmiths and craftsmen of old, who were forced to design rings and brackets to accommodate candles, the then principal source of light, and that the modern design must assume the electric lamp as existing and adjust itself to the lamp. The last two years have proved the truth of that idea. The modern fixture has neither candles nor round bulbs. What a wonderful field is offered to the imagination of the fixture designer; what a variety of ideas have been created and are still in the process of being created! Only a year and a half after the idea was first suggested in the ELECTRICAL WORLD, James T. Holmes was able to make the following statement:[2]

> Really for the first time in the history of lighting an attempt is made to produce lighting as such, based on present modes and now available appliances. We are designing lighting today on the basis of light sources of our time and age rather than adapting new light units or lamps to older forms of fixtures.

About six months later[3] H. Vandervoort Walsh gave the architect's viewpoint:

> Already we see progress. Fixtures for electric lights are not designed as reminiscent of candlesticks and oil lamps, but are appearing in new forms, expressive of new wonders of lighting. Many of these shapes are ugly, but a surprising number are very beautiful and original.

But one peculiar feature has established itself in the whole development of modern lighting equipment. It is so persistent and so objectionable that it seems necessary to discuss it in detail. Getting away from candles and round bulbs, modern units appear principally in the form of flat glass over very shallow fixtures or long glass panels or metal panels likewise on very shallow fixtures, all requiring long tubular lamps. The very same fixture designers who previously insisted that it is impossible to produce artistic effects without candles or round bulbs now insist that it is impossible to do so without long tubular lamps, and since the present tubular lamps give insufficient illumination the demand is made that lamp manufacturers concentrate on the creation of tubular lamps of higher wattage. The following statement[2] of Mr. Holmes may be considered as representing the opinion of the best minds among the designers of lighting equipment:

> Up to now the lamp engineers have been ahead of the designer of equipment, but now I feel that the designer is ahead of the engineer. The requirement is for a lamp running from 60 to 200 watts, with a filament in the neighborhood of 12 in. in length.

Even though some tubular lamps of considerable wattage have been produced in small numbers, it is not very likely that lamp manufacturers will accept the idea with a great deal of enthusiasm and start quantity production of large tubular lamps. The metal filament or any other filament by nature is not suitable for this form of lamp. Furthermore, there would never be more than a limited field for them for decorative purposes, since the majority of all lamps used are for utilitarian purposes.

Here and there hope is expressed that luminescent gas discharge tubes without filament will solve the problem of high lumen tubular lamps. A recent thorough and competent review[4] of this subject by Dr. M. Pirani makes it appear that the widespread use of such luminescent tubes for general purposes of illumination, even though within the range of possibility, lies in the remote future, and the illumination of large glass surfaces by luminescent gas is even far more remote.

The tubular lamp with filament is expensive, inefficient and unnecessary. The claim that it is impossible to produce artistic modern effects without it is based on the same wrong principle as was the claim that it was impossible to do so without candle brackets or candle rings. A competent designer should be able to assume any size lamp for granted and build an artistic fixture around it, over it or under it, and he will be forced by circumstances in the future to do so, just as he was forced and found very excellent means to get away from the round bulb.

> **The craftsmen of old produced very artistic fixtures for candles as then existed and did not insist that candle makers must produce spherical or elliptical candles.**

The time is ripe to emphasize the necessity for concentrating on the development of equipment for standard

[1] ELECTRICAL WORLD, *October 6, 1928.*

[2] *See paper before the Illuminating Engineering Society in March, 1930 ("Transactions of the I.E.S.," May, 1930).*

[3] *September, 1930, "Transactions of the I.E.S."*

[4] *"Elektrotechnische Zeitschrift," June 19, 1930.*

high-wattage bulbs. "Architect co-operation" has held the platform so consistently that it has been generally forgotten that a modern lighting installation, in addition to being artistic, must also be economical and give a certain amount of correct illumination.

The results are just beginning to show themselves, complaints are beginning to be heard about the high cost of replacement of unheard-of quantities of tubular lamps, the high bill for energy caused by these very inefficient units and the generally insufficient amount of very necessary illumination in lobbies, theaters, etc., in spite of the great amount of money expended on lighting equipment. There are expensively equipped office building lobbies in which it is difficult to read the building directory. There are banks in which thousands of dollars have been expended on lighting equipment consuming many many kilowatt-hours and in which there is not sufficient light for signing a check. There are theaters, elaborately and modernly equipped, in which it is almost impossible to read the program notes, even when all the lights are turned on during intermission, and the use of pocket cigar lighters for the purpose is quite common.

Is it any wonder that building managers are beginning to complain? It is almost certain that some very elaborate modern installations will soon have to be torn out.

It should be possible, and it is possible, to produce any desired artistic effects in high-ceilinged rooms by the use of high-wattage lamps high up in the ceiling or under the ceiling. Passing the buck to the architect for not allowing sufficient space for large units does not solve the problems. Good architects have shown a remarkable adjustability to modern lighting ideas and will continue to do so. For high ceilings the problem of using large lamps should be comparatively easy of solution. This does not necessarily exclude the use of supplementary smaller units to add to the decorative effect. It merely means that the only proper way to provide correct lighting in a high room is by means of large lamps in high locations. But even for low ceilings, even for the home, where the problem of using high-wattage lamps is more difficult to solve, it is not impossible of solution, and there are signs in the sky that the public will demand such high-wattage lamps even for low ceilings and that the competent fixture designer will find ways and means for providing suitable equipment for them. The recently becoming popular indirect floor lamp with a 300- or even 500-watt lamp in the home is one instance, the coming out of rather artistic forms of totally indirect units as high as 500 watts, with rather pretty lighting effects on the bottom of the fixture and suitable for low ceilings, is another instance.

There is another important problem in modernistic lighting. It is expected that standard lamps for general illumination will soon be available which will emit a generous proportion of ultraviolet rays, not enough to cause any sunburn or injury even at continuous exposure, but sufficient to be at least as beneficial as sunlight. Practically all the types of glass now used in modernistic lighting are excellent absorbers of ultraviolet and would be useless with these new lamps. With direct lighting the problem is easy of solution, because both chromium and aluminum are good reflectors of ultraviolet, but the standard inclosing units now so popular and the flat glass and cylindrical glass used in modernistic designs could not be used at all.

There is no doubt that entirely new ideas will have to be developed, and it would be well for designers of lighting equipment to begin now to study the problem seriously.

Appropriations for lighting equipment have been more generous in the last two years than ever before. The artist has had his swing, has been able to use his imagination to produce lighting equipment of permanent artistic value. As encouraging as this may seem, it is not sufficient. Building owners and managers will soon say that they have learned the lesson that lighting equipment cannot be left to chance, that it must form an integral part of interior or exterior architecture and decoration, that

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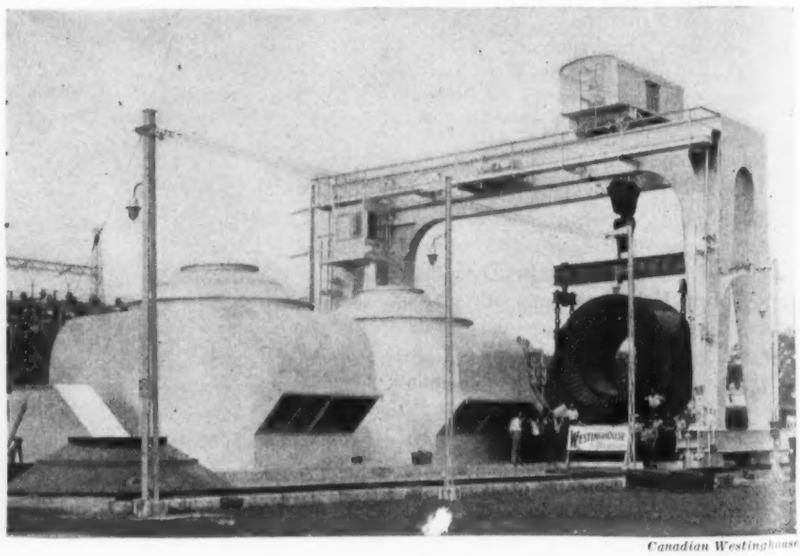
Outdoor Synchronous Condensers for Ontario Hydro

At the Leaside substation of the Hydro-Electric Power Commission of Ontario two Westinghouse 25,000 - kva., 500 - r.p.m., 25-cycle outdoor type, vertical, synchronous condensers have been installed. Two more are planned for later installation.

Here the exciters and control are located in an underground chamber. An elaborate system of subterranean passages connects portions of the unusual station. The vertical type of semi-buried equipment is said to increase ease of repairs and replacements; the outdoor construction to have reduced superstructure costs.



Canadian Westinghouse

they are willing to spend considerable amounts of money on such equipment compatible with the cost of the surroundings, and that they are also satisfied that they must spend more money on electric energy. But they will say that they desire to know what the cost of this energy will be. What the cost of lamp replacement will be and how much of a nuisance it will be. In addition to all artistic effects, the users desire to know just how much light they will get on desks, books and artistic displays, and whether or not they will be able to read a newspaper without the aid of a cigar lighter.

These questions will become more and more persistent as time goes on. After all, the question of whether or not a lighting installation will be made so that a person will be able to see deserves some little place in the chart of the fixture designers. In order to be able to answer these questions without hiding one's face in shame it will be necessary to resort to new ideas in fixture design. All such new ideas, whether we want it or not, will have to be built around the standard high-wattage lamp. With all due respect to the artistic fixture designer, he cannot answer these questions. It is precisely within the jurisdiction of the illuminating engineer, who will have to be consulted more and more on the design of illumination equipment.

Those who see the signs in the sky and begin to prepare for the future, superimposing their artistic ideas upon sound and economic illuminating engineering, will soon be the leaders in the field of illumination equipment; a most promising engineering opportunity.

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READERS' FORUM

Not All Ground Bus Designs Follow the California Plan

To the Editor of the ELECTRICAL WORLD:

I was very much interested to see from the article on "New Substation Design Saves a Quarter of a Million," by R. B. Pollock, in your issue of February 28, that the Southern California Edison Company has now extended the ground bus idea to 66 kv. If my information is correct, the idea originated with that company and was first used by it on 220 kv. It was so ingenious that it would be difficult to suggest any method of simplifying it. Since most ingenious ideas are simple, they are generally passed over with insufficient appreciative comment. It is indeed encouraging to see that the engineers of the Southern California Edison Company are continuing their simplification and do not follow the lead of others who purposely or through incompetence build awe-inspiring complicated monstrosities and call them substations, which are then proclaimed as great pieces of engineering.

Maybe I will be permitted to call attention to the fact that some who attempted to copy the simple California ideas have made a mess of it, as those who copy often do. The principal reason for this is probably due to the fact that the California stations generally contain two breakers per circuit with no bypasses, transfers, H diagrams or similar Christmas trees. The ground bus is excellently suited to the two-breaker scheme. But very few companies in the East would authorize the expenditure for more than one breaker per circuit. And when only one breaker is used, with a Christmas tree of disconnects, it is quite easy to make a mess of it with any design scheme. The complicated ground-bus arrangements used by some should therefore not be attributed to the Californians, who originated and are logically following out the idea.

M. M. SAMUELS.

J. G. White Engineering Corporation,
New York.

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Synchronous Motors Applied to Most Difficult Drive

To the Editor of the ELECTRICAL WORLD:

There has recently come to our attention an article entitled "Synchronous Motors Applied to Most Difficult Drive," which appeared on page 952 of the November 22, 1930, issue of ELECTRICAL WORLD. There appear in the article statements which we believe are not true and which, because of their relation to the products we manufacture, should be corrected for the readers of ELECTRICAL WORLD. The inference is left that a hog mill drive, with its extremely difficult starting requirement, has been driven for the first time in the General Electric Company installation described, and that the drive was made possible by the scheme described for preventing the motor from stalling when pulled out of step by the momentary peak loads sometimes placed on the hog mill.

The installation at the Weyerhauser mill, Everett, Wash., described in this article was, we believe, made in 1928. Two years previous to this, in August, 1926, the Electric Machinery Mfg. Company successfully applied a synchronous motor to a No. 25 CRSF Mitts & Merrill hog at the Packard Motor Car Company plant, Detroit, Mich. The motor was 300 hp., 900 r.p.m. The hog was used for reducing wooden packing cases to size which could be used for fuel in the boilers. This installation was, we believe, the first application of a synchronous motor to a hog for reducing wood. In July, 1926, was installed at the Akron Rubber Reclaiming Company, Barberton, Ohio, another Electric Machinery synchronous motor for driving a Mitts & Merrill hog for reducing old tires preparatory to reclaiming them. This motor was 300 hp., 1,200 r.p.m., and was, we believe, the first synchronous motor to be applied to a hog.

On both these installations engineers of the Electric Machinery Mfg. Company anticipated the possibility of high momentary peak loads that would cause the synchronous motor to pull out of step. The motors for these hog installations were not designed to carry through the highest possible load peaks which would be applied; instead, they were allowed momentarily to fall out of step and immediately resynchronize. Stalling was no problem with Electric Machinery Mfg. Company field-responsive control, since this simple control has the inherent feature of automatically removing field excitation from the motor whenever it is out of step so that it can immediately resynchronize.

S. P. BORDEAU.

Electric Machinery Mfg. Company,
Minneapolis, Minn.

BOOK REVIEWS

Organization Engineering

By Henry S. Dennison. McGraw-Hill Book Company, New York. 204 pages. Price, $2.

Certain industrial establishments have been used as laboratories in the school of personnel administration and are cited as models of organization efficiency. The author of this book is a proprietor of one of these manufacturing plants. He discusses the factors which influence the industrial worker's reaction to his physical and human environment, the motivation behind his purposeful behavior and those applications of organized effort which have been most successful in promoting a contented staff with smooth functioning for favorable productivity. The principles are of broad applicability to any kind of organization.

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Bulletin of the National Research Council

Industrial Research Laboratories of the United States. Fourth edition. Published by the National Research Council of the National Academy of Sciences, Washington, D. C. 267 pages. Price, $2.

More than 1,600 laboratories engaged in industrial research are listed, with notes regarding the character of staff and nature of research being handled.

Laboratories connected with federal, state or municipal governments, or with educational institutions, have been excluded from this survey, although frequently they are engaged upon investigations of industrial problems. Most concerns which are not actually supporting laboratories in their own works have not been included, nor have most of the associations maintaining fellowships in certain educational institutions.

Forschung auf dem Gebiete des Ingenieurwesens

VDI Verlag, Berlin, NW7.

Constituting the second year's publication, in expanded form, of the periodical heretofore known as "Technische Mechanik und Thermodynamik," this new publication in the field of experimental research also embodies a continuation of the "Forschungshefte" beginning with No. 340 of the series. The January issue reports studies on a transparent centrifugal pump and includes articles on thermal properties of refrigerants, on turbulent flow in fluids and on temperature regulation for industrial furnaces.

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Elektrophysik der Isolierstoffe

By Dr. Andreas Gemant. Julius Springer, Berlin, Germany. 220 pages.

This book treats of the dielectric properties of insulating materials as well as breakdown phenomena. It is written for both the technical man and the physicist. The former is thereby enabled to extend his knowledge from the practical into the physical and mathematical side of the subject. The physicist will have the incentive that comes from seeing what problems are important technically. The treatment is that of a textbook rather than a manual, for the subject is still in a state of flux and finality is not yet possible. An extensive bibliography includes numerous American and English references.

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Electrical Power Transmission and Interconnection

By C. Dannatt and J. W. Dalgleish. Isaac Pitman & Sons, New York. 424 pages, illustrated. Price, $7.50.

Transmission and distribution of electricity in bulk and by the use of networks of lines and stations supplying overhead and underground lines introduces new and complex engineering problems. The network, power stability, inductive co-ordination, transients, corona and other new terms have been incorporated as essential parts of this kind of engineering.

In current publications this material may be found in an unco-ordinated manner, but the authors of this book have presented the complete subject in an orderly manner. The treatment is quantitative and in terms of topics. There is little descriptive matter of interpretation of physical aspects. The use of vector algebra, vector power, symmetrical co-ordinates and superposition are typical of the new and useful tools used by the authors. Any engineer who studies this book will have a quantitative grasp of the subject to the degree of completeness known today.

The authors develop the quantitative treatment of line constants on lines and cables and quantitatively treat of corona, networks, line calculations, power limits, stability, short circuit calculations, inductive co-ordination, neutrals and transient phenomena.

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Elektrische Machinen

By Dr. Ing. Rudolf Richter, Julius Springer, Berlin, Germany. 707 pages.

A very complete and excellent analytical treatment of the electrical characteristics of synchronous machines and converters under both stable and transient operating conditions is given in this book. The simple case of the ideal machine is discussed first, then the analysis is extended to special cases that exist in actual machines. Special consideration is given machines with definite poles and with cylindrically shaped rotors for operation under both single and polyphase load conditions. This book should be of value to both advanced students of electrical engineering and engineers who are responsible for the design of synchronous machines, because it deals primarily with the fundamental conceptions and principles involved in such machines, and only devotes a relatively small part to the actual design considerations and calculations.

Several features of interest to American engineers are not considered, however. The principal omissions are: (a) Effect of generator characteristics such as short-circuit ratio on stability of operation; (b) definition and calculation of the equivalent leakage reactance characteristics of synchronous machines under transient operating conditions; (c) characteristics of two-winding synchronous generators in which each winding can be operated independently.

Men of the Industry

B. A. Behrend Gets Honorary Degree from Darmstadt

BERNARD A. BEHREND, who has long been prominent in the electrical engineering world of America, has just received fresh evidence of the European recognition he also enjoys through the bestowal upon him of the honorary

degree of doctor of engineering by the University of Darmstadt, Germany, for "meritorious work in the construction of induction machines."

Dr. Behrend, who is a native of Switzerland, came to the United States in the nineties and became identified successively with the Bullock Electric Manufacturing Company as chief engineer, with the Allis-Chalmers Company, the engineering department of which organization he founded, and subsequently with the Westinghouse Electric & Manufacturing Company as advisory engineer. He has won distinction as an electrical inventor, becoming the recipient of a gold medal from the St. Louis Exposition of 1904 and of the John Scott medal of the Franklin Institute in 1911. He holds more than 70 patents and is the author of several technical books, including "The Induction Motor—Its Theory and Design," published in 1900, translated into French and German and recently reissued by the McGraw-Hill Book Company under a more comprehensive title. Dr. Behrend is an old contributor to ELECTRICAL WORLD, articles by him having been printed as far back as 1898, and is the writer of many monographs for other American and European technical journals.

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W. H. HOLCOMB, manager of the pump department of the Pelton Water Wheel Company, San Francisco, has been appointed general sales manager with duties embracing sales and distribution of all company products. Mr. Holcomb entered the employ of the company in 1919 as sales engineer.

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B. L. EDDY, Roseburg, and E. F. SLADE, Salem, have been appointed by Governor Meier to serve without compensation as members of the newly created Oregon State Hydro-Electric Commission. Mr. Eddy is a member of the state senate and an attorney. Mr. Slade is president of the First National Bank of Salem. C. E. STRICKLIN, state engineer, is the third member of the commission.

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MONTELLE C. SMITH, manager of the Baton Rouge Electric Company for about four years and president of the Louisiana Steam Products Company, has been transferred to El Paso, Tex. He will be succeeded in Baton Rouge by R. F. NELSON, Richmond, Va. Mr. Smith, who has been connected with Stone & Webster companies for nearly 20 years, was active in the establishment of the Louisiana Steam Products Company and the resultant large steam plant. He is a native of Maine. In 1917 he was manager of the Plymouth & Brockton Railway. Later he was manager of the Cape Breton Electric Company at Cape Breton, Nova Scotia, going from that city to Baton Rouge.

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A. M. CHITTY, for the past five years manager of the southern district of the Puget Sound Power & Light Company in Washington, with headquarters at Chehalis, has been named manager of the southwestern district of the company, succeeding ROME C. SAUNDERS, who has been transferred to the company's executive offices in Seattle. Mr. Chitty, a member of the A.I.E.E., was at one time with the Puget Sound company in Everett, Wash., and before coming to the Pacific Coast was with the Ottawa Electric Railway Company and the Westinghouse Electric & Manufacturing Company. Mr. Saunders has represented the Puget Sound company in Tacoma for eighteen years.

Successive Steps in Career of A. W. Leonard

A. W. LEONARD, whose resignation as president of the Puget Sound Power & Light Company to become chairman of the Engineers' Public Service Company, the parent organization, was announced in the news columns last week, has been

connected with the Stone & Webster interests for 36 years, more than half of which have been spent in Seattle. He was made president of the Puget Sound company on November 1, 1914, upon the death of Jacob Furth. Under his presidency the company won the Charles A. Coffin medal in 1928 and the Forbes public service cup in 1929.

Mr. Leonard was born in Monmouth, Me., in 1873. His early affiliations include the Edison Electric Illuminating Company of Brockton, Mass., of which he was superintendent and manager. In 1901 he went to Houghton, Mich., as superintendent of the Houghton County Electric Company, later becoming manager, and in 1905 he was appointed manager of the Minneapolis General Electric Company, later becoming vice-president. Still later he became district manager of the Stone & Webster interests in the Middle West, moving to Seattle in 1912, when he became affiliated with the Puget Sound Power & Light Company. Mr. Leonard has been prominent in social and civic affairs in Seattle.

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ARTHUR STRASBURGER, member of the Los Angeles Board of Water and Power Commissioners since October, 1930, was elected president of the board March 12

to succeed Dr. JOHN R. HAYNES, who resigned the presidency but who remains as a member of the board. Mr. Strasburger has for many years been prominent as a business executive in Los Angeles. Dr. Haynes has been president since September, 1929.

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W. C. Bell Heads New England Division, N.E.L.A.

WILLIAM C. BELL was elected president of the New England Division of the National Electric Light Association at the annual meeting in Boston March 20. Mr. Bell is a native of San Antonio, Tex., and after being graduated in engineering at the University of California was employed in 1910 in the operating department of the Sierra & San Francisco Power Company, soon entering the same branch of service with the Pacific Gas & Electric Company. In 1911 he went East to join the designing department of the Virginia Electric & Power Company at Richmond, and in 1912 he was appointed superintendent of construction. Two years later he became assistant general superintendent, and in 1920 he was made chief engineer and purchasing agent, being appointed general manager of the light and power division in 1924.

In 1927 Mr. Bell was appointed general manager of the Narragansett Electric Lighting Company, Providence, R. I., and a year later he was made vice-president of the New England

Power Association with headquarters at Boston. In this last post he has general supervision of the retail utility properties of the far-flung organization and has acquired a high reputation among the younger utility executives of the Northeast for his co-ordinating abilities and enterprise.

McElhoes Now President of Oklahoma Utilities Association

S. I. MCELHOES, who was elected president of the Oklahoma Utilities Association at the recent convention of that

body, was born in 1876 on a homestead in Madison County, Neb. Persevering in his studies despite adverse circumstances, in June, 1901, he was graduated from the College of Law, University of Nebraska, afterward building up a practice in Lawton, Okla., and serving as Assistant Attorney-General for that state in 1913 and 1914 and as city attorney of Lawton for nine years.

Mr. McElhoes became general attorney for the Southwestern Light & Power Company in September, 1922, and devoted much effort to developing the company, of which he was made vice-president in 1927 and manager on January 1, 1929. He is an earnest advocate of keeping the public informed about utility matters.

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JOHN B. POSTON, president of the Southern Ohio Power Company, was elected a member of the board of directors of the Columbus Railway, Power & Light Company, Columbus, Ohio, at the recent annual meeting of stockholders. He succeeds the late William C. Willard, who was a vice-president of the company. Mr. Willard's position as vice-president was not filled.

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BERT H. PECK, formerly chief engineer of the Public Utilities Commission of the District of Columbia, has been appointed assistant to the president of the Washington Gas Light Company with headquarters in Washington. A graduate electrical engineer, Mr. Peck brings to his new position extensive technical and practical experience obtained through association with engineering undertakings in various parts of the country. Before joining the Public Utilities Commission of the District of Columbia last year Mr. Peck's connections since 1906 included the Illinois Bell Telephone Company, D. C. and William Jackson, consulting engineers, the Illinois Public Utilities Commission, now known as the Illinois Commerce Commission; Southern Illinois Light & Power Company and its successor, the Illinois Power & Light Corporation, and the Solvay Process Company. He is a member of the American Institute of Electrical Engineers.

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OBITUARY

CHARLES SIDNEY KNIGHT, manager of the electrical and wire-rope sale division of the American Steel & Wire Company at El Paso, Tex., died March 11 at the Worcester (Mass.) office of the company. Mr. Knight was 66 years old and a native of Worcester. He began his career in the wire industry with the Washburn & Moen Company, Worcester.

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DR. BENJAMIN W. STILWELL, senior vice-president of the Westchester Lighting Company, died suddenly of heart disease on March 18 at his home in Yonkers. He was the father of Colonel John Stilwell, vice-president of the Consolidated Gas Company of New York. Although he possessed law and medical degrees from Columbia University, Dr. Stilwell never practiced either law or medicine, devoting himself to banking and the development of the lighting company. He had other important business interests and had been chairman of the Yonkers Board of Education.

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J. L. STANNARD, chief engineer of the Tacoma (Wash.) Department of Public Utilities, died in Glendale, Calif., on March 13, after an illness of less than a month. Mr. Stannard had been the main agent in the development of the Cushman power project of Tacoma, of which the second unit is rapidly nearing completion, and his improvements and economies were an asset of great importance to the plant. He was born at Chittenango, N. Y., in 1866, was graduated from Cornell University, and before he settled in Tacoma in 1923 had been employed in important irrigation, waterworks and power-plant developments all along the Pacific Coast. He was consulting engineer for the North Coast Power Company in Portland, Ore., from 1912 to 1919.

FEDERAL TRADE INVESTIGATION OF UTILITIES

Alabama Power Company

Evolved in

Four Financing Stages

Steam and Regional Hydro Aptly Co-ordinated

Publicity Program Subjected to Scrutiny

THE testimony of investigators and witnesses before the Federal Trade Commission involved the publicity program of the Alabama Power Company in relation to newspapers, advertising agencies, legal counsel, local civic organizations, and to some extent its attitude toward participation in political campaigns.

President Martin on the stand asserted that the company had made no contributions to a citizens' committee to help it defeat a bond issue for free books in the schools nor for the support of a paper called the *Taxpayers' Information Bureau*. Nor was any contribution made toward the political campaigns of a senator and a governor in connection with the latest election.

Chief Counsel Healy called attention to a "formidable-appearing list of attorneys throughout the State of Alabama," but President Martin assured him that none of them was expected to engage in political activities on behalf of the company; they had been kept busy during the past five years handling the company's interests in 822 lawsuits brought in 54 of the 64 counties in which the company operates, claiming damages amounting to $8,208,935. He added that, "so far as political activity is concerned, some years ago we adopted this policy with respect to the attorneys: that whenever they accepted public office we would ask for their resignation so that men who might go into public office would not enter having a retainer from us."

As for newspapers, neither the company nor any of its officers or affiliated companies invested in or financially supported any paper in Alabama.

W. J. Baldwin, who had handled all publicity and advertising, asserted that advertising was not placed in five of the daily newspapers or in four or five weeklies because they were distinctly unfriendly to the Alabama Power Company. He admitted having made efforts, with some success, to induce the Westinghouse and General Electric companies to place their merchandise advertising in newspapers favorable to the power companies. C. A. Bingham, counsel for the power

ANOTHER in the series of interpretations of the Federal Trade Commission investigation of electric utilities. This insert deals with the testimony and data developed concerning the Alabama Power Company's corporate, financial and physical history, its experience as to rate of return and practice as to rates for service.

Others will follow as the hearings of various companies are concluded in order that our readers may have a perspective view of the trend of the investigation and its bearing on public attitude toward the industry.

company, raised objection to the admission of letters substantiating these points, because they were not written by company officials, were not found in the company's files, were not addressed to the company, which knew nothing about them, but were portions of correspondence carried on by outside parties and had no direct connection with the case. Ruling on their admissibility was suspended by the examiner presiding; later they were withdrawn by Judge Healy on the basis of their incomplete identification.

Mr. Baldwin further said he had never written an editor asking for favorable editorials, but did discuss with editors facts controverting unfavorable press material which appeared in their columns. It was also brought out that Mr. Baldwin had asked an employee of the Commonwealth & Southern Corporation, of which Alabama Power is a subsidiary, to use his influence with the General Electric Company or its subsidiary, the Hall Electric Heating Company, to cease giving undue prominence to low rates of a certain municipal plant in advertising an electric heating product.

Advertising in connection with the acquisition of municipally owned plants carried the name of the private utility interested, and such as was prepared for other agencies to use carried notice that the Alabama Power Company was paying for the space. Pamphlets were supplied to schools only on request of the schools, with no specific mechanism to make their availability known to the schools. The monthly organ, *Powergrams*, is sent to employees, libraries and newspapers. Relations with many of the Alabama newspapers are friendly, as evidenced by the apologies which more than 50 of them wrote to the company after they had carried adverse plate matter of the Farmers' Federated Fertilizer Company in support of its bid for the government plant at Muscle Shoals. The inference was elicited that the regular advertising of the Alabama Power Company was appreciated; the fertilizer company had meanwhile paid for no advertising.

A low-power broadcasting station was maintained for two years to disseminate market news and entertainment features which would be of value to the people of Alabama. None of the news related to the company or its activities and no one was allowed to discuss Muscle Shoals or Boulder Dam over the station. It was subsequently donated to the Alabama Polytechnic Institute.

In a report to President Arkwright of the Georgia Power Company, also chairman of the N.E.L.A. civic development committee, Mr. Baldwin said:

> The Alabama Power Company has contributed to all community chests; employees have been encouraged to join churches, the chambers of commerce, the luncheon clubs, secret orders and other organizations in the community and to show a real interest in their activities; local occasions, such as parades, cornerstone layings, patriotic celebrations, and so forth, have always found as participants Alabama Power Company employees. This, naturally, has been a source of good will and its value to public relations cannot be overestimated.
>
> Public relations and commercial officials of the company co-operated in 1927 with local organizations, such as chambers of commerce and luncheon clubs, in interesting new industries in Alabama. While the company usually initiates such projects, credit is always given to local organizations and citizens, and for public consumption it is made to appear that the Alabama Power Company co-operated with the local people in securing new industries rather than giving itself the full credit.

In interrogating C. A. Beasley, the legal agent who conducted many of the company's negotiations with the government on the Muscle Shoals case, it developed that he had cleared his files as rapidly as matters terminated, returning engineering and economic data to those who had originated it. Commissioner McCulloch said: "It seems there has not been much to find with the files periodically discarded." Judge Healy, however, in terminating the hearing, said:

> **I would like to state for the record that it is my information that the Alabama Power Company has permitted the commission's representatives and examiners to see whatever they desired to see; that there has been full co-operation in helping us to conduct the investigation that the Senate in Senate Resolution 83 ordered us to conduct.**

EVIDENTLY POWER COMPANIES need to be circumspect in their relation to newspapers, schools and political campaigns if they are to enhance public confidence in their ethical integrity. The best of motives in these respects may be subverted to the ends of those who would deny to utility corporations the prerogatives of self-defense and self-preservation, which are commonly recognized to be within the proprieties for industries less affected with a public interest.

Any company which can conscientiously justify its policies and practices in these matters should certainly use the most appropriate channels for their expression if the commission hearings are not thought by the utility or permitted by the commission to afford a sufficiently adequate and propitious forum.—EDITOR.

Early Financing Against Heavy Odds

Initial market for utility securities limited
Foreign capital depended upon at the outset
Electric Bond & Share Company facilitated capital expansion

PERHAPS no unit in America's great power system better illustrates early difficulties of financing and later phenomenal growth than does the Alabama Power Company. In the days of its inception in 1906 the investing public was not educated to the merits and possibilities of the power and light industry and declined to advance funds for its development. Like many other American enterprises, the company depended in its early stages upon English capital, but was later able to secure adequate funds in home markets. It was originally sponsored by a Canadian company, the Alabama Traction, Light & Power Company, which held control until the Alabama Power Company was acquired by the Southeastern Power & Light Company in 1924.

Alabama Power Company's expansion took place in four major merger movements. In 1913 there were merged with it Alabama Electric Company, Wetumpka Power Company, Alabama Power & Electric Company and the Alabama Power Development Company. In 1915 another merger took place in which Huntsville Railway, Light & Power Company, Decatur Light, Power & Fuel Company, Etowah Light & Power Company and Pell City Light & Power Company entered the organization. Then in 1918 Little River Power Company was added, and in 1926 Birmingham, Montgomery & Gulf Power Company and Sheffield Power Company were taken in. In 1927 Houston Power Company, Gulf Electric Company and Alabama Power Company were merged into the present Alabama Power Company.

Early sources of capital

As already intimated, Alabama Power Company secured its funds for expansion during its early years largely from the Alabama Traction, Light & Power Company. In its early stages, its chief sponsor, Captain Lay, became associated with James Mitchell, who reorganized the company in 1913. It had secured equipment through the Alabama Traction, Light & Power Company on the security of its note. At the outbreak of the World War money was hard to get, especially by an unproved organization such as Alabama Power Company was at that time. It became necessary to raise more funds, and the company subordinated the old bonds which it had given the Alabama Traction, Light & Power Company in exchange for its own securities to a new issue. Capital was then raised in the United States. Until these bonds could be marketed the Alabama Power Company arranged with the Electric Bond & Share Company to lend it up to $2,000,000 and to negotiate for the sale of its three-year 6 per cent gold bonds. Similar arrangement was later made for the company's 5 per cent bonds. No further assistance was needed at the time.

Electric Bond & Share rendered aid during early financing

In 1920 Electric Bond & Share Company helped Alabama Power Company distribute its first stock issue and received $2 a share commission or a total of $98,658.

From 1925 to 1929 the Southeastern Power & Light Company and/or Southeastern Securities Company advanced more than $51,000,000 on short-time loans to the company. At the same time, incidentally, the Alabama Power Company loaned Southeastern Power & Light Company and/or its subsidiary, Southeastern Securities, more than $15,000,000.

The common stock of the Alabama Power Company in March, 1928, was virtually all under the names of Neil A. Weathers and Stephen A. Dawley for account of the Southeastern Power & Light Company, and in February, 1930, Commonwealth & Southern Corporation acquired this stock by merger with the Southeastern.

The first major merger was in 1913, as stated. In this transaction property and plant accounts were charged with five items aggregating $9,900,000 in addition to the charges to plant accounts for construction expenditures. About $3,574,000 was spent for construction out of a total of $13,474,000. The original authorized capital of Alabama Power Company amounted to 50 shares with a par value of $5,000. Upon the consolidation this was

increased to $20,000,000, divided into 200,000 shares of $100 stock. This was designed to take care of the stock of the consolidated companies to be issued to holders of 995 constituent company shares, having a par value of $99,500, to be surrendered. For these were issued 99,750 shares with a par value of $9,975,000. All but twenty shares were issued to the Alabama Traction, Light & Power Company. Thus the owner of each share of Alabama Power Company stock before the merger received 1,399 additional shares of the consolidated company stock. An exchange basis was arranged for the stock of the other constituent companies.

Consolidation process proceeds

In the process of its earlier mergers Alabama Power Company acquired the capital stock and bonds of fourteen companies in the utility business from the Alabama Traction, Light & Power Company, Ltd., which company, as stated, also owned the Alabama Power Company. In return the Alabama Power Company issued to the parent company its hundred-dollar-par value common stock totaling $8,776,000 and $1,224,000 of 6 per cent income bonds, making a total of $10,000,000. The par value of the securities received in return was $3,306,096. The difference of more than $6,000,000 was charged to fixed capital on the books of the Alabama Power Company. Certain of the companies acquired at this time had been owned by the Electric Bond & Share Company and were transferred by it to the Alabama Traction, Light & Power Company prior to the merging.

The total charges to fixed capital during the period 1913 to June 30, 1920, aggregated $21,678,532. Book value of fixed capital at June 30, 1921,was $35,163,482. The book value of fixed capital on Sept. 31, 1929, was $166,461,574, or an increase of $131,308,091 in 9½ years due to mergers, purchases and construction.

The Dixie Construction Company had been organized to carry on construction activities for the Alabama Power Company. On construction jobs in process, interest charges were added to fixed capital; a total of something in excess of $23,000,000 represents fixed capital on the books of the Alabama Power Company, accumulated in this way.

Investments held by the Alabama Power Company during the period 1916 to 1929 included, among other items, common stock with a ledger value of $252,000 and advances of $106,595 in the Muscle Shoals Hydro-Electric Power Company, and 750 shares of the Dixie Construction Company, for which it paid $75,000. They were sold to the Wynona Coal Company in January, 1922, at a profit of $48,957. This profit represented the undistributed surplus of the Dixie Construction Company on Dec. 31, 1921. The Wynona Coal Company was controlled at the time by the Alabama Traction, Light & Power Company, but had previously been controlled by the Alabama Power Company.

Funded debt of the company

The principal amount of bonds actually issued by the Alabama Power & Light Company during the period 1913 to 1929 inclusive was $136,991,000, covered by eleven different issues. As already stated, the first $10,000,000 of this, its first mortgage, 50-year 6 per cent gold bonds were held by the Alabama Traction, Light & Power Company, Ltd. For reasons already stated, the bondholders agreed to subordinate the lien of this issue so that the Alabama Power Company could issue its bonds and preferred stock, which would not be junior to the first mortgage bonds, and the company issued its first mortgage 6 per cent three-year gold bonds. And in April, 1916, the $10,000,000 of first mortgage bonds were canceled and the amount was credited to the open account of the Alabama Traction, Light & Power Company.

In 1920 it was suggested by the officers of the company that the financing by preferred stock could not be done unless the indebtedness of the company to the Alabama Traction, Light & Power Company, amounting to approximately $11,000,000, was made to rank and follow after the preferred stock both as to principal and as to interest. Accordingly an issue of 100-year gold debenture certificates was created and made subordinate to the preferred stock, and issued to fund the account of the Alabama Traction, Light & Power Company. The debenture issue totaled $12,170,000. Later the Southeastern Power & Light Company acquired this issue of $12,170,000 debenture certificates and held it in its investment account until June 30, 1929, when it surrendered the certificates in exchange for 893,247 shares of the Alabama Power Company's no-par common stock.

Another issue of bonds was added in 1915 when $2,000,000 were sold to Harris, Forbes & Company, yielding proceeds of $1,893,247. In this case Electric Bond & Share Company acted as agent in the sale of the issue. Electric Bond & Share Company received $20,000 for its services and the bonds were called for redemption in August, 1916, at 101. The interest charge for the period the bonds were outstanding, eighteen months, was 16.2 per cent, a yearly rate of 10.8 per cent. Of the total amount of bonds sold, $112,821,000, the discount totaled $9,022,620 and expenses $820,784. The net proceeds were thus $102,977,595 and all of the issues were sold to Harris, Forbes & Company for cash. The total mortgage bond indebtedness of the Alabama Power Company issued between 1914 and 1929 was $136,996,000, on which the total amount of discount and expense was $12,002,130. The total deductions from this amount aggregated $8,821,598, leaving an unamortized balance on Dec. 31, 1929, of $3,180,532.

EARNINGS STATEMENT OF THE ALABAMA POWER COMPANY AND SUBSIDIARIES

Calendar Years	1930	1929
Gross earnings	**$17,910,572**	**$18,337,201**
Operating expenses, including taxes and maintenance	**7,654,693**	**6,953,000**
Gross income	**$10,255,878**	**$11,384,200**
Fixed charges	**4,030,110**	**4,155,647**
Net income	**$6,225,768**	**$7,228,552**
Dividends on preferred stock	**$2,006,648**	**$1,883,396**
Provision for retirement reserve	**920,515**	**950,000**
Balance	**$3,298,604**	**$4,395,155**

Note—The above figures for 1929 include operations of gas properties sold on May 1, 1929.

Stream Fluctuations Require Extensive Steam Reserve

Alabama Power takes entire output of government's Wilson Dam plant at Muscle Shoals. Leases nitrate plant No. 2 from government.

Consistent reductions in rates to all classes of service have induced enlarged usage in farm and city.

Divisional operating organization supplemented with headquarters technical staff.

BY 1930 the Alabama Power Company produced approximately 95 per cent of all electric energy sold to the public in the State of Alabama. It collected about 75 per cent of the gross electric revenues from the sale of electric energy. It furnished directly electric service in all but a few counties in south-central Alabama, in the section east of Mobile Bay, in about a dozen municipally owned systems and in the city of Birmingham. It sold at wholesale the major part or entire supply of electric energy distributed in Birmingham and in several of the municipally operated systems. It has no interconnections with the systems in southern Alabama operated under the name of the Alabama Utilities Company.

It is a chief source of supply of power to the Mississippi Power Company, operating in the entire length of the eastern part of that state. It also supplies the Gulf Power Company, operating in western Florida. It has numerous high-tension transmission lines of large capacity interconnecting at the state line with the Georgia Power Company system, and also has interconnections with the Tennessee Electric Power Company over the northern boundary of the state.

Run-of-river and storage plants

The company owns and operates six hydro-electric plants in east-central Alabama, approximately between the cities of Birmingham and Montgomery. Three are on the Tallapoosa River and three on the Coosa River. These rivers unite near Montgomery and form the Alabama River, which reaches the Gulf of Mexico near Mobile. Both the Tallapoosa and Coosa Rivers are subject to great variety in flow. During protracted low-flow periods the output of these plants may be seriously reduced. On the Coosa River are three plants known as Lay Dam, Mitchell Dam and Jordan Dam, all ranked as run-of-river plants.

The three plants have installed capacity totaling 326,000 kw. and generate usually from 300,000,000 to 400,000,000 kw.-hr. a year each. In 1929 they generated a total of a little more than 1,000,000,000 kw.-hr. at an average production cost, labor and superintendence, supplies and maintenance, of about 0.2 mill per kilowatt-hour.

On the Tallapoosa River, farthest upstream, about 40 miles from Montgomery, is the Martin Dam, completed in 1927. Back of this dam is a large storage reservoir with capacity sufficient to generate 501,000,000 kw.-hr. by a draw-down of 60 ft.

Seven miles downstream is the Upper Tallassee plant, completed in 1928. A few miles farther downstream is a new plant completed in the fall of 1930, on the site of an old cotton mill dam and power plant. These three plants have a combined capacity of 257,000 hp. Lower Tallassee was not in operation until late in 1930, but the two other plants generated about 400,000,000 kw.-hr. in 1929, at an average production cost of a little more than 0.3 mill.

In the words of the commission's investigator, J. C. Dickerman:

All the stations are modern and high class, apparently durable and at the same time attractively designed and built.

The book values of five of these plants are carried by Alabama Power Company at figures equal to $142 per kilovolt-ampere, or about $106 per horsepower of present installed capacity. Several of the plants have foundations ready for additional generating units. There is reason to believe that the actual direct original expenditures for these plants was considerably less than the moderate figure of $106, since to the structural costs have been added a sum equal to about 20 per cent of the total book value as apportionment of certain costs of the company, stated to represent costs of lands, water rights and sites purchased by issuance of stock of the Alabama Power Company of a par value equal to the amounts referred to.

So far these plants have operated at a group average capacity output factor of between 50 and 60 per cent. In 1928 and 1929 their output, together with purchases from Muscle Shoals and certain other lesser sources, was sufficient to meet system demands with only a slight amount of generation by steam power.

The two largest steam stations are located in the Warrior Coal fields about 25 miles northwest of Birmingham, on the Black Warrior River. Here are combined condensing water in ample supply and coal directly from mines near by. These plants are known as Gorgas No. 1, whose first unit of 20,000 kw. capacity was installed in 1917, the second unit of 30,000 kw. installed by the government in 1918 and purchased by the company in 1923, and the third unit of 20,000 kw. installed in 1924, completing the

ultimate installation of 100,000 hp., or about 70,000 kw., and the Gorgas No. 2 plant of 60,000 kw., installed in August, 1929, as part of a possible ultimate installation of 240,000 kw.

Both of these units are well-built, modern plants, though of lower steam pressure than is the practice in very recent years in plants which are to be run as base load or main supply plants. These plants were installed primarily to carry the load during periods of low water resulting in inadequate output of hydro-electric power.

Gorgas No. 1 is now a second reserve plant. When operating at a good output factor of around 50 per cent it produced energy at an operating cost of 4 mills per kilowatt-hour. The book cost of this plant is $5,361,646.67, equivalent to $76.70 per kilowatt of capacity. Thus its output, allowing 12 per cent for return on investment, taxes and depreciation, figures a total cost per kilowatt-hour generated at 50 per cent output factor of 6.1 mills.

Gorgas No. 2 plant should operate at considerably less cost, possibly at 3 mills. Its cost was reported as $5,732,226, equal to $95.54 per kilowatt of capacity. A similar calculation brings the total estimated cost per kilowatt-hour generated at 5.6 mills, a portion of the estimated saving in operation being absorbed by the greater investment charges. It is safely to be estimated that these plants can produce, under system load factors, power at 6 mills or less per kilowatt-hour, at the busbars, interest on property cost being included.

Coal for these plants is purchased from an affiliated company, which owns and operates the mines. The price to Alabama Power Company is stated to be recently $2.64 per ton delivered at the plant for 12,500 B.t.u. washed coal. This is said to be the prevailing contract price delivered for similar quality coal from independent mines in the Alabama Coal fields.

There are the small reserve plants not kept under fire but supplied by skeleton crews for emergency service.

Interchange with industrial steam plant

An affiliated company owns a steam electric plant, known as the Magazine plant, near Mobile, which is operated by Alabama Power Company. This is a somewhat unique situation. The plant was erected and is operated primarily to supply steam and electric power to a mill of the International Paper Company near by. The paper mill also owns a bark-burning steam boiler plant near by. These two boiler plants are operated so as to balance as nearly as possible steam requirements with power requirements for the mill. The electric plant is tied into the Alabama Power system, but is likely to be a user rather than a provider of power on that system.

The company leases from year to year under a revocable contract the 60,000-kw. steam electric plant which is part of the government-owned, wartime-built nitrate plant No. 2, near Sheffield, about 2 miles from Wilson Dam on Muscle Shoals. Until the completion of Wilson Dam in 1925 and the increase in the company-owned hydro plants, this plant appears to have been operated during the dryer months of the years. In some months in 1925 it produced an average of more than 1,000,000 kw.-hr. a day, or a high capacity output factor. In 1927 it was operated only a few days and in 1928-1929 and probably 1930 not at all.

The Alabama Power Company has paid a fixed rental of $10,000 a month, which is included in the production cost of power in the classified operating expenses to be later referred to, keeps the plant in good condition and repair, pays insurance costs, operates it when it desires at its own cost and pays the government an additional 2 mills for each kilowatt-hour actual output of the plant.

For the period 1921-1929 under the lease, the War Department has been paid a total of $1,522,990 for the use of this plant. Coal used at this plant cost $3.50 a ton, of high heating value, as an average since 1925. This plant was not started until it was evident power available from other sources could not be obtained at less cost. While this was a well-built plant and considered efficient at the time of its design and erection, it operates under conditions which make it much less economical than those under which the Gorgas plants can be run.

The government completed the Wilson Dam hydro plant during the summer or early fall of 1925, with an installation of eight main generating units, having a combined rated capacity of 184,000 kw. or 260,000 hp. This installation is estimated to operate at full load about 57 per cent of the year—that is, the river flow would be sufficient. For 97 per cent of the time it would carry a load of 66,000 kw. or more.

At times of very low water the river flow would yield scarcely 40,000 kw. Examiner Dickerman saw the plant in October, 1930, when it was able to maintain but about 45,000 kw. of load. The substructures and buildings are ready for ten additional units, which would increase the total installed capacity to 612,000 hp. or about 440,000 kw. However, the river flow would enable full operation of this capacity for only 25 per cent of the time during the year.

Mr. Dickerman continued:

It is of no advantage to Alabama Power Company to purchase Muscle Shoals power at 2 mills if its own hydro plants are operating, since the out-of-pocket cost of generating in its own plants is 0.22 mill. Since generating costs in its steam plants range from 3 to 6 mills when operating at good load factors—of which costs from 2 to 4 mills are fuel costs, saved if the plant were shut down—it is evidently to the advantage of the Alabama Power Company to purchase power primarily when it can substitute the purchased power for the operation of the steam plant. Generally, power in large amounts has been taken during the period of the year when hydro operation was handicapped and reduced by river conditions. Yet such river conditions in its own plants are apt to affect the Muscle Shoals output similarly.

The net result has been that less than 25 per cent of the possible kilowatt output of Wilson Dam has actually so far been generated, yet at various times Alabama Power Company has taken under its contract all the power Wilson Dam could supply so that it could not have supplied other possible customers with steady power.

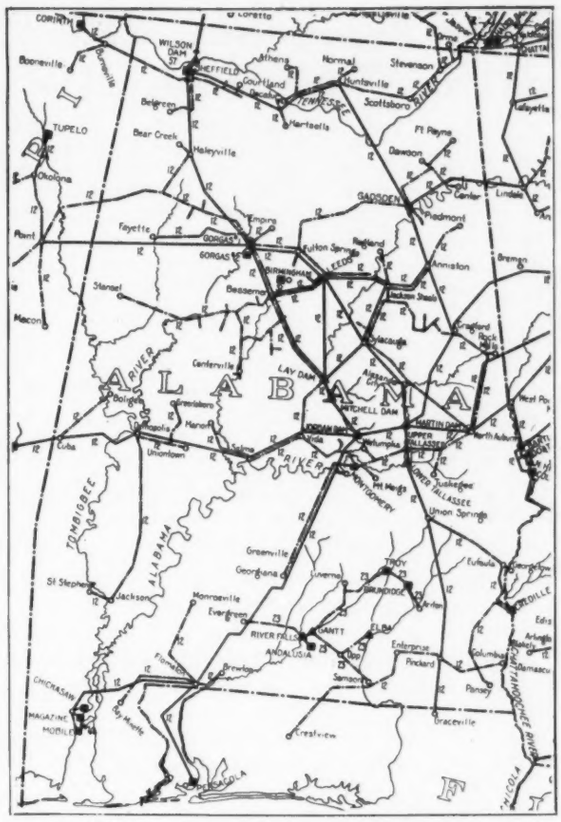
By 1929 the Alabama Power Company had ample generating capacity to meet its entire needs, including furnishing much power to its affiliated companies. Without Muscle Shoals power available it would have been obliged to operate its steam plants at a net increase in cost over the purchase price, which I have estimated as between 1 and 2 mills. Judging from the large takings of power from Muscle Shoals in 1926 and 1927 at the same time that it operated all three of its principal reserve steam stations to produce 231,000,000 kw.-hr. in 1926 and 310,000,000 kw.-hr. in 1927, it may be properly inferred that the availability of Muscle Shoals during those years was vital. For 1928 and 1929 and for partial information covering 1930, no such deduction can be drawn. In these last three years it has been wholly a matter of advantage rather than necessity to the Alabama Power Company.

In 1927, the largest year's output, the company put into the system 1,759,143,119 kw.-hr.; in 1928, 1,586,177,553, and in 1929, 1,715,250,122. The year 1927 appears to have been the high period up to 1930. In 1928 48.6 per cent of the total kilowatt-hours were generated by the company's own hydro-electric plants, 18.4 per cent by steam and 33 per cent were purchased. In 1929 hydro-generated in company plants had increased to 84.3 per

I WAS IMPRESSED with the high-class engineering and grade of construction everywhere in evidence about those properties which have been constructed under the management of Alabama Power Company and its affiliates. The properties were well maintained, clean, well appointed, good housekeeping evident everywhere. Advantage seemed to be taken of new ideas in equipment available from several makers. Employees generally seemed to be furnished with good conveniences and good working conditions. The whole organization reflects painstaking ability.

Information asked for was supplied in unusually good arrangement and in ample detail. Physical equipment and staff organization and personnel seemed constituted to render high-grade service. The generally moderate unit costs of installation and operations reflect the skill and judgment of the management, together with low-cost advantages of that section of the country.

J. C. DICKERMAN,
Federal Trade Commission Investigator.



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Alabama's transmission network

Lines marked 12 are Commonwealth & Southern System, operated by Alabama Power Company. Voltages shown range from 44 kv. to 110 kv. Muscle Shoals in upper left at Wilson Dam. Lines marked 23 are Alabama Utilities Company, with which Alabama Power Company is not interconnected.

cent, steam generated had declined to 0.5 per cent and purchased power to 15.2 per cent. The year 1929 was classed as a good water year. The 1929 output reflects the new hydro plants of the period 1927-1929.

Purchased power, being at practically a fixed price per kilowatt-hour, remained at 2.33 mills in 1927 and 1929, but was a little higher in 1928.

The combined effect of expenditures for all kinds of power resulted in a drop from 0.2273 mill per kilowatt-hour sold in 1927 to 0.1066 mill in 1929.

This drop was due to the large increase and low production cost in the hydro-electric generation and the decrease in some outside purchased steam energy. These figures do not carry any element representing interest or return on the investment, nor the cost of carrying the current from the stations to the consumers. They are costs at the station. With all classified operating expenditures included the net effect was a slight reduction in system operating expenditure both in dollars and in unit cost. The latter amounted to 5.22 mills in 1927 and to 4.90 mills in 1929. This average operating cost of 5 mills per kilowatt-hour sold includes no interest or profit on the investment but includes all other costs, as far as the station busbar, ready to go out onto the transmission system.

Residential rates have declined from 7.75 cents per kilowatt-hour in 1926 to 5.56 cents per kilowatt-hour in 1929. The latter reflects the reduction in residential rates, together with broader grouping of uses of current under the residential rates which became effective in February, 1929. All the smaller consumer average revenues have declined, but a somewhat unusual situation is revealed in that average revenues from industrial and other electric companies increased nearly 1 mill and the average revenue from all sales went up from 1.03 cents per kilowatt-hour in 1926 to 1.22 cents in 1929.

While the total number of kilowatt-hours sold in 1929 and 1928 was less than in 1927, the total revenue in dollars increased from $15,900,312.71 in 1927 to $17,433,654.47 in 1929. The increase in average revenue in sales to industrial consumers was not due to an increase in rate but to a decline in average annual consumption per customer, thus causing a large proportion of all bills to be made out in the higher steps of the schedule. On the other hand, increase in consumption by residential consumers and commercial consumers tended to throw billings into the lower steps of the schedules, while the large increase in numbers of consumers and total kilowatt-hours consumed swelled the revenues.

Average revenue per kilowatt-hours from industrial power rose from 0.95 cent to 1.02 cents, while average revenue from sales to other electric companies rose from 0.62 cent in 1926 to 0.72 cent in 1929. The average annual sales per residential consumer rose from 363 kw.-hr. with an average bill of $28.15 in 1926 to 557 kw.-hr. with a bill of $31 in 1929.

Rate reductions, some of which were ordered by the Alabama Public Service Commission, have brought about an estimated decrease of $1,000,000 in revenue, some of which, however, was obscured by attendant increase in consumption. There was a reduction of $146,000 in the total revenue of 1929 from that of 1928 in spite of the fact that the kilowatt-hours for residential consumption increased more than 7,500,000.

Fixed capital high, operating ratio low

Fixed capital at the close of 1929 was equal to $292 per kilowatt of owned generating capacity. The fixed electric capital per dollar of gross revenue from electric operation was $8.98.

In 1929 operating expenditures, not including taxes and depreciation, were 26.1 per cent of the net operating revenues, or inclusive of the latter named item, 40.5 per cent. That is, of each dollar of revenue 26.1 cents was expended in operations including maintenance, 14.4 per cent went for taxes, licenses and into a retirement fund, and 59.5 cents was available for interest, dividends and surplus.

Taxes in 1929 were the heaviest ever levied. They amounted to 1.02 per cent on the total fixed capital, to 0.1117 cent on each kilowatt-hour sold and to 9.2 per cent of the net operating revenues.

From 1919 to 1929 the net income amounted to $23,265,042.86; of this $9,008,712.84 was paid out in preferred dividends, $10,527,697.15 in common stock dividends and the balance, $3,730,130.64, added to surplus. The dividend rates and computed per cent return on property and invested capital are as detailed in the accompanying table.

Service to 500 communities

In 1929 the company was serving a population of 1,750,000 in 493 communities, with 103,674 customers directly served and 90,000 through other distribution agencies. The generating capacity was more than 1,000,000 hp. to serve, through 1,000,000 kva. of substation capacity, a connected load of practically the same amount which created a system demand of 376,400 kw. Total kilowatt-hours generated and purchased amounted to 1,715,250,122. Of this amount in 1929, a good water year, only 0.4 per cent was steam-generated. Forty per cent of the output went to power customers and 37.34 per cent to other utilities, mostly subsidiaries or associated companies other than municipalities, which took 1.28 per cent.

Purchases from the United States government at Wilson Dam, more than 500,000,000 kw.-hr., represented 95.93 per cent of the total purchases. Subsequent to a temporary agreement with the government for power purchase while the Muscle Shoals units were being tested, a new agreement was made (1926) in which the following rates were to be paid per kilowatt-hour: 2 mills for power replacing Gorgas steam power; 3 mills for that replacing Gadsden steam output; 4 mills to replace nitrate No. 2 steam power; 2 mills

for power resold to other utilities. These rates still hold. During 1929 the company agreed to take at least $500,000 worth at these prices but had to pay $169,-725.83 for power not taken in order to meet the $500,000 commitment. The guarantee was made $560,000 in 1930, and the draft brought the payments to $583,000 for the first eleven months of the year.

From Sept. 1, 1925, to Nov. 30, 1930, the Alabama Power Company has paid the United States government $3,682,823.93 for 1,709,046,000 kw.-hr. from the Wilson Dam plant at Muscle Shoals. The average yearly cost per kilowatt-hour has ranged from 2.06 mills in 1926 to 3.02 mills in 1929.

In connection with nitrate No. 2 steam plant leased from the government, a rental of $10,000 per month is paid in addition to a 2-mill rate for all generated output and the operation, maintenance and insurance of the plant at company expense.

The total payments during 1925-1929 inclusive have amounted to $948,087.87 and the output has been 181,760,000 kw.-hr., all produced in 1925-1927, the good water years of 1928 and 1929 not justifying the operation. The average operating cost per kilowatt-hour for the 1926 and 1927 period was 0.57 mill. Including the monthly rental item, the cost ranged from 6.42 mills in 1925 to 15.07 in 1927.

Plant operating costs at the Alabama Power Company's own Martin Dam plant ranged from 0.267 mill in 1927 to 0.317 mill in 1929. The same costs at Gorgas steam plant No. 1 ranged from 3.887 mills in 1925 to 1.104 in 1929, with a high of 11.001 in 1928 due to abundance of hydro power and minimized steam operation on the system. Plant-operating costs at the hydro plants ranged during the 1926-1929 period: Lay Dam, 0.184 to 0.2 mill; Mitchell Dam, 0.167 to 0.238 mill.

Rural use more than doubles

In spite of the difficulties created by the sparse settlement of farming communities, real progress has been made in extending rural service.

As of Sept. 1, 1930, the company reported 9,442 rural consumers of 453 lines, with an average of 5.3 consumers per mile of line and an average consumption of 840 kw.-hr. per year per consumer at an average rate of 4.67 cents. These rural data do not include 13,000 consumers, their consumption, etc., in 143 small communities of less than 1,000 population each.

The annual kilowatt-hour consumption per rural customer in 1924 was 383 kw.-hr.; in 1925, 137 kw.-hr.; 1926, 446 kw.-hr.; 1927, 780 kw.-hr.; 1928, 834 kw.-hr., and 1929, 840 kw.-hr.

Headquarters are in a fine office building in Birmingham. The staff is divided into eight departments: secretarial, treasury and accounting, sales operations, legal, land, publicity, and medical.

The territory served is divided into six main divisions, each with a division manager and a complete operating staff—accountants, cashiers, salesmen, engineers, superintendents of operation, line crews, and so forth.

The divisions are further divided into districts with a district manager and a staff similar to that of the division manager, only abbreviated in numbers and extent of territory to be cared for. Billing of consumers' accounts is done for each division at division headquarters. Only general books are kept at Birmingham. Control is maintained by traveling auditors.

The operating department maintains a staff working out of Birmingham. This staff closely controls the operations of the generating stations but exercises only supervisory control of the transmission and distribution systems, which are operated and maintained under the direction of the respective division managers.

Activities to stimulate the sale of electric merchandise are supervised from the Birmingham office. A considerable variety of electric appliances were on sale in each public office visited.

Major construction, both in design and construction, is carried out by an affiliated corporation—Allied Engineers, Inc.—a successor to Dixie Construction Company of the Southeastern Power & Light Company organization. Another separate organization, Commonwealth & Southern Corporation of New York, with stock owned by the several operating companies in the Commonwealth & Southern of Delaware group, provides a group of engineers who keep close track of daily operating conditions of the several companies and provide the plans for the most economical and useful co-ordination of operations. Both of these special organizations maintain offices and staffs in Birmingham to function for the group of companies in the Southeast.

The smaller construction work, distribution lines, services, customers' transformer stations and other installations are put in by the engineers and superintendents of divisions and districts.

Since Alabama Power Company is a very important source of power for several of the Southern group of companies within the Commonwealth and Southern group, its relations with the adjoining affiliated companies, both in matters of co-ordinated daily operation of sources of power and in plans for additions to power plants, interconnected transmission circuits and substations, are primarily the object of study by subsidiary organizations which represent the holding company's over-all interest. Thus the plans for future development and day-by-day operations are not the sole determination of the executive staff of Alabama Power Company, but are outlined for it by representatives of the holding company. Thus in recent years power plants have been built in advance of the immediate needs of Alabama Power Company because the output of such plants could be disposed of to other companies which might not be able to develop their own sources of power so advantageously. Even the contracts of Alabama Power Company for Muscle Shoals power are made in view of its ability to transfer without quibbling some of the power thus obtained to affiliated companies.

All employees receive an examination by the medical staff of the company when hired, and yearly thereafter. The company pays the premiums on group life insurance covering all employees, thus providing a death benefit fund. Pensions for superannuated employees are provided by the company.

Return on Property Investment Excluding Working Capital

Year	Before Depreciation	After Depreciation	After Non-Utility Deductions	Rate of Dividend on Common Stock	Rate on Invested Capital	Rate on Investm't and Borrowed Capital
1920	**5.85**	**5.28**	**8.71**	**0**	...	...
1921	**6.02**	**5.85**	**8.61**	**0**	...	...
1922	**6.67**	**6.0**	**8.45**	**2**	...	...
1923	**6.78**	**6.51**	**8.67**	**3**	...	...
1924	**6.66**	**6.4**	**7.68**	**3**	...	...
1925	**7.17**	**6.25**	**6.99**	**4.13**	**5.3**	**4.7**
1926	**7.19**	**6.41**	**7.08**	**8.34**	**8.5**	**7**
1927	**7.25**	**6.49**	**8.39**	**5.52**	**8.3**	**6.5**
1928	**6.82**	**6.11**	**7.49**	**6.9**	**9.1**	**6.6**
1929	**6.98**	**6.36**	**7.70**	**9.23**	**7.9**	**6.2**

The average dividend on common stock for the seventeen-year period from 1913 to 1929 inclusive was 3.8 per cent.

Financial and Statistical News

TOTAL public utility security offerings this week amounted to more than $36,000,000 and several large issues, including that of Consolidated Gas, are on the horizon awaiting satisfactory market conditions. A large volume of prospective financing has accumulated during the lull since January's heavy operations. High-grade utility bonds continue firm with little change in quotations this week.

——CURRENT MONTHLY STATEMENTS OF POWER AND LIGHT COMPANIES are in many cases below the corresponding month last year, as the decline then did not set in until about April. With gradual industrial improvement this year's figures should take the lead shortly. The ELECTRICAL WORLD index of 37 utility common stocks now stands at 74, against 73.5 last week and 65.7 at the beginning of the year.

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Details Announced of Berlin Utility Loan

FORMAL ANNOUNCEMENT of the details of the plan whereby an international banking syndicate has provided the city of Berlin with an intermediary credit of 75,000,000 reichsmarks and will reorganize the municipal electric works of the city has been made.

The syndicate is under the leadership of the Prussian State Bank and the Reichs - Kredit - Gesellschaft A. G. It includes the Deutsche Bank and Discontogesellschaft, the Berliner Handelsgesellschaft, the Commerz-und Privatbank, the Darmstaedter und National Bank, the Dresdnerbank, Mendelssohn & Company and M. M. Warburg & Company, J. Henry Schroeder & Company represent the syndicate for England; the Basler Handelsbank for Switzerland and Mendelssohn & Company of Amsterdam and the Nederlendsche Handelmaatschappij N. V., for Holland.

As announced in the March 21 issue of the ELECTRICAL WORLD the American participants are Harris, Forbes & Company, the Chase Securities Corporation, the J. Henry Schroeder Banking Corporation, Otis & Company and the United Light & Power Company.

A new corporation with a capital of 240,000,000 reichsmarks will be formed, to which will be transferred the Berlin City Electric Works and the nominal 15,000,000 reichsmarks shares of the Berlin City Electric Company, owned by the city.

As compensation, the city of Berlin will receive the proceeds of the shares of the new corporation and in addition the new corporation will take over the approximately 320,000,000 reichsmarks of long term non-interest bearing debt of the city to the Berlin City Electric Company, so that the total purchase price will amount to about 560,000,000 reichsmarks. The shares will be divided into 160,000,000 reichsmarks par value of "A" shares and 80,000,000 reichsmarks par value of "B" shares. The latter are to have double voting rights. The "A" shares are to be offered for private subscription. The "B" shares are to be taken over by the city of Berlin, Electric Power Corporation of Germany and Prussia Electric Company.

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American & Foreign Power Has Chilean Contract

AMERICAN & FOREIGN POWER COMPANY, INC., recently announced receipt of a dispatch from A. W. McLimont, its vice-president in Chile, advising that Compañia Chilena de Electricidad, its principal subsidiary in Chile, had signed a 90-year franchise or concession contract with the government of Chile covering its electric light and power and tramway operations in Santiago, Valparaiso and adjacent territory.

American & Foreign Power Company, Inc., purchased control of the Santiago and Valparaiso properties from British interests January 1, 1929, and the present settlement represents the consummation of negotiations with the Chilean government initiated by the previous owners in 1927. This new contract supersedes the present contracts and confirms the franchise or concession rights of the company, including hydro-electric rights, for its development and operations for a period of 90 years from April 1, 1931.

The public lighting contract in Santiago, which had been in dispute between the city and the previous owners, has been adjusted and the city of Santiago has paid Compañia Chilena de Electricidad approximately 8,500,000 pesos, or the equivalent of approximately $1,000,000, in full of amounts due for service previously rendered, and the street-lighting contract has been confirmed for a period of 25 years from date. A new street-lighting contract in Valparaiso for a term of 30 years has been negotiated.

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Bucharest Electric Deal Not Yet Completed

IN REFERENCE TO THE despatches from Bucharest and Paris to the effect that the electric properties in Bucharest had been acquired by Electric Bond & Share Company for its subsidiary, American & Foreign Power Company, Inc., C. E. Calder, president of American & Foreign Power Company, Inc., states that while for several months his company has had representatives in Rumania investigating the power and light and artificial gas properties owned by the city of Bucharest and serving it, negotiations have not been concluded.

It is contemplated by American & Foreign Power Company, Inc., provided the purchase of the Bucharest properties is concluded, to acquire also the Jalomita hydro-electric power project of the Hydrofina Company, which is owned by French and Belgian interests. This latter company owns hydro-electric plants in the vicinity of Bucharest and supplies at wholesale a part of the power requirements to the city.

▼

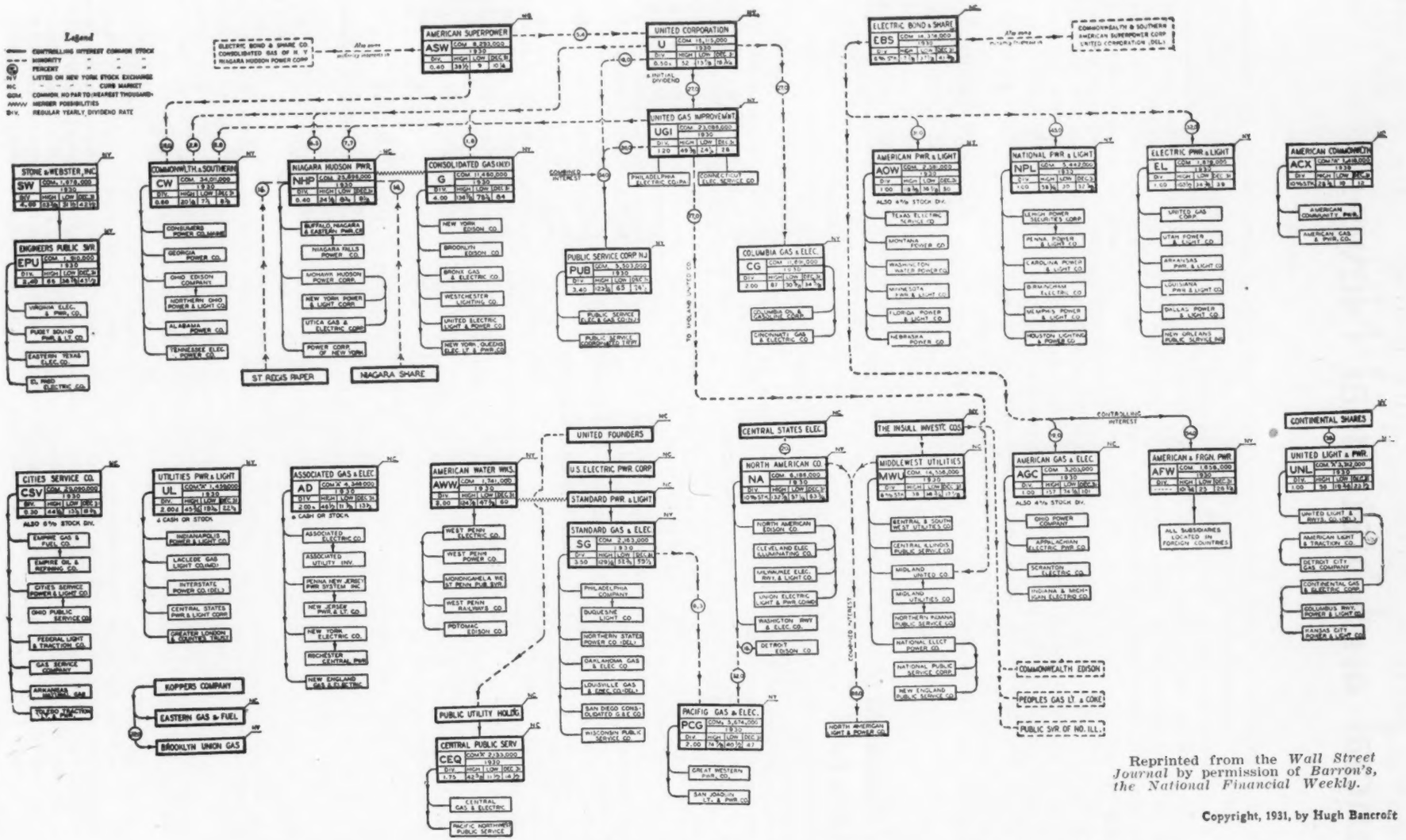
New Partners Head Kidder-Peabody

THE 66-YEAR-OLD investment banking house of Kidder, Peabody & Company, Boston, Mass., has been dissolved and has been succeeded by a new partnership to continue business under the same name. The new partners are Edwin S. Webster, Jr., Boston; Chandler Hovey, Boston, and Albert H. Gordon, New York City.

Edwin S. Webster, Jr., has been associated with Stone & Webster for the past six years. Mr. Hovey is well known in Boston brokerage circles as head of the banking house of Chandler Hovey & Company, and Mr. Gordon has been associated with Goldman, Sachs Company since 1925.

Inter-Relation of Principal Public Utility Holding and Investment Companies

(January 1, 1931)



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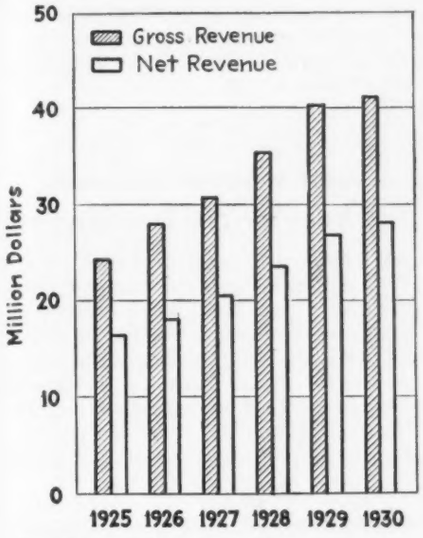
The above graphic representation is designed to show the various interrelations existing between the leading units in the power system. It does not presume to be entirely comprehensive, not including, for example, the New England Power Association group. It does, however, include the leading Eastern companies comprising what is improperly called the "power trust" by government ownership advocates. Information shown includes company name, ticker tape designation, dividend, stock range, etc.

Southern California Edison Cuts Rates; Earnings Grow

A FAVORABLE credit position with insurance companies and an equitable ratio in its capital structure are cited by Southern California Edison Company as factors facilitating financing operations. Such conditions have



Southern California Edison earnings show consistent growth

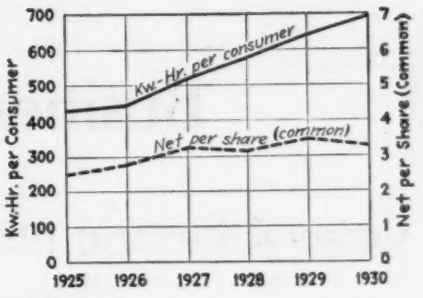
an important bearing on the selling price of an issue as well as its marketability.

The company had a very satisfactory year in the face of adverse business conditions. Gross earnings amounted to $41,128,735, an increase of 2 per cent over 1929, notwithstanding substantial reductions in rates announced late in 1929, but which did not become fully operative until 1930. Operating economies are reflected in net earnings, which amounted to $28,082,407, an increase over 1929 commensurate with the increase in gross revenues. These earnings provided ample margin for fixed charges, depreciation and dividend requirements. Giving consideration to the voluntary reduction in rates, which affected gross earnings to the extent of approximately $2,000,000, the balance available for common stock was equal to $3.25 per share on the average number of common shares (2,807,819) outstanding during the year. This compares with $3.44 per share in 1929 (2,537,943 shares) and $3.10 in 1928.

Under the new-business program vigorously carried forward during the year, 330,975 hp. of new business was signed, which was the largest volume contracted in any single year of the company's history, except the peak year 1929.

On December 31, 1930, the company's outstanding funded debt amounted to $140,776,000 par value, of which $106,153,000 represented bonds issued under the refunding mortgage and $34,623,000 underlying bonds. Total assets on that date amounted to $375,745,077 an increase of $16,325,349 over 1929.

Through the medium of its customer-ownership plan, which has been in effect since 1917, 122,045 investors at the close of the year were shareholders in the capital stock of the company.



Electrical output on the up-grade

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NEW CAPITAL ISSUES

Public Service Electric & Gas Company issued first and refunding mortgage gold bonds to the amount of $26,000,000, the price being 93¾ and interest, to yield 4.33 per cent.

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New England Public Service Company issued 40,000 shares of prior lien preferred stock at 99 and accrued dividend, to yield about 7.07 per cent.

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A $2,000,000 issue of 5 per cent, 30-year first trust mortgage gold bonds of the Nevada-California Electric Corporation was offered at 93.

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The Jersey Central Power & Light Company has offered a $3,700,000 issue of first mortgage and refunding, twenty-year, 5 per cent gold bonds, series B.

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

OPERATING COMPANIES

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
Alabama Power					
(Year ended January 31)					
Gross earnings	$17,904,444	$18,247,080	—1.9	43	38
Net earnings	10,186,890	11,324,276	—10.0	..	..
Consumers Power					
(Year ended January 31)					
Gross earnings	32,392,912	33,413,877	— 3.1	45	49
Net earnings	17,937,748	17,157,874	4.5	..	..
Detroit Edison					
(Year ended January 31)					
(Gross earnings	52,983,006	56,592,768	— 6.4	68	66
Net earnings	16,869,192	18,993,645	—11.2	..	..
Georgia Power & subs.					
(Year ended January 31)					
Gross earnings	25,201,087	23,294,603	8.2	50	48
Net earnings	12,652,110	12,096,336	4.6	..	..
Gulf States Utilities					
(Year ended January 31)					
Gross earnings	7,082,957	6,723,348	5.3	57	54
Net earnings	3,060,757	3,079,556	— 0.6	..	..
Kansas City Power & Light					
(Year ended January 31)					
Gross earnings	14,820,279	14,601,885	1.5	48	50
Net earnings	7,654,110	7,227,889	5.9	..	..
Nevada-California Electric					
(Year ended January 31)					
Gross earnings	5,717,390	5,693,519	— 4.2	48	49
Net earnings	2,994,114	2,896,652	— 3.4	..	..
Ohio Edison					
(Year ended January 31)					
Gross earnings	19,126,066	19,430,200	— 1.6	39	42
Net earnings	11,635,000	11,248,287	3.4	..	..
Puget Sound Power & Light & subs.					
(Year ended January 31)					
Gross earnings	16,956,306	16,499,557	2.8	55	59
Net earnings	7,697,646	6,754,175	14.0	..	..
Southern California Edison					
(Year ended January 31)					
Gross earnings	$41,183,719	$40,662,626	1.0	31	33
Net earnings	28,198,580	27,395,973	3.0	..	..
Tennessee Electric Power					
(Year ended January 31)					
Gross earnings	14,646,130	14,915,733	— 1.8	53	51
Net earnings	6,955,971	7,361,368	— 5.5	..	..
Virginia Electric & Power & subs.					
(Year ended January 31)					
Gross earnings	17,123,195	17,140,843	— 0.1	55	54
Net earnings	7,661,273	7,794,767	— 0.2	..	..

HOLDING COMPANIES

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
American Water Works & Electric & subs.					
(Year ended January 31)					
Gross earnings	53,782,780	54,344,430	— 1.0	51	50
Net earnings	26,125,898	27,079,137	— 3.5	..	..
Cities Service					
(Year ended January 31)					
Gross earnings	59,145,893	46,795,692	26.4	..	..
Net earnings	56,553,824	45,413,729	24.4	..	..
Commonwealth & Southern & subs.					
(Year ended January 31)					
Gross earnings	140,635,674	147,497,347	— 4.7	49	49
Net earnings	72,252,316	75,452,163	— 4.2	..	..
Public Service Corp. of New Jersey & subs.*					
(Year ended January 31)					
Gross earnings	138,542,498	138,058,071	3.5	68	69
Net earnings	43,937,399	42,397,127	3.6	..	..

* Operating expenses include depreciation.

Business News and Markets

General Electric 1930 Earnings Exceeded Only by 1929

COMPARED with any year other than 1929, General Electric Company has had a very successful year. Earnings in 1930 were the largest on record, 1929 excepted, Gerard Swope, president, said last week. Orders received during 1930 amounted to $341,820,312, compared with $445,802,519 in 1929, a decrease of 23 per cent, and unfilled orders at the end of the year totaled $56,062,000, compared with $94,623,000 at the close of 1929, a decrease of 41 per cent. Sales billed for 1930 were $376,167,428, compared with $415,338,094 in 1929, a decrease of 9½ per cent. Net income from sales in 1930 amounted to $40,450,261, which, compared with $49,395,896 in 1929, shows a decrease of 18 per cent. These figures for 1930 do not include radio set and tube business, which was transferred to the Radio Corporation of America on January 1, 1930, except that derived from General Electric radios, which were introduced the latter part of the year.

A comparison of income and expenses for 1930 with the previous year follows:

	1930	1929
Net sales billed	$376,167,428	$415,338,094
Less: Cost of sales	335,717,167	365,942,197
Net income from sales	$ 40,450,261	$ 49,395,896
Income from other sources	13,453,654	9,681,386
Interest and discount	3,258,498	3,153,044
U. S. Gov. securities	1,757,715	3,929,834
Royalties, etc.	1,605,334	4,661,814
	$ 20,075,202	$ 21,425,079
Total income	$ 60,525,463	$70,821,976
Less: Interest payments	$ 313,078	$ 450,806
Addition to reserve	2,721,470	3,081,289
	$ 3,034,548	$ 3,532,096
Profit for dividends	$ 57,490,915	$ 67,289,880
Less: 6 per cent cash dividends on special stock	2,574,952	2,574,819
Profit for common dividends	$ 54,915,962	$ 64,715,060
Less: Regular common dividends	46,150,203	32,449,285
Extra cash dividends on common		7,210,949
Surplus for the year	$ 8,765,758	$ 25,054,826

The International General Electric Company, which handles all export business outside of Canada, yielded a profit available for dividends of $1,519,198, compared with $1,708,064 in 1929.

Because of the severe economic depression throughout the world, a special appraisal was made of the securities owned by the International Company, and General Electric Company's investment in the International Company was adjusted to conform. The appraisal was based upon the lower of cost or market at the end of the year for those securities having a recognized market on one of the international exchanges, or upon an examination of the net worth on the books of the companies whose securities have no such market.

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Three General Electric Lighting Conferences

THREE LIGHTING CONFERENCES, to be held at the General Electric Lighting Institutes at Nela Park, Cleveland, Ohio, and Harrison, N. J., have recently been announced.

The first will be held at Harrison, April 6-11, and will consist of a course in the fundamentals of lighting practice. The second course, the illuminating engineers' conference, will be held at Nela Park, April 20-22. Such timely subjects as recent developments in ultra violet radiation, general lighting plus, lighting of the windowless factory building, etc., will be discused. The third course, to be held at Nela Park, April 23-24, will be a lighting sales conference.

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Westinghouse Receives Order for Six Transformers

AN ORDER HAS BEEN RECEIVED by the Westinghouse Electric & Manufacturing Company from the Electro-Metallurgical Company involving about $100,000 for six 5,000-kva. transformers to supply power to electric furnaces. Electro-Metallurgical is a subsidiary of the Union Carbide & Carbon Corporation and is building one of the largest plants of its kind at Boncar, W. Va.

Power to operate the transformers will be obtained from a hydro-electric plant being built on the New River near Gauley Bridge, W. Va., by the New-Kanawha Power Company, another Union Carbide subsidiary, where four 30,000-kva. Westinghouse waterwheel-type generators will be installed.

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Westinghouse Points Way Out of the Twilight Zone

THE program to increase lighting sales, called the "Twilight Zone Plan," inaugurated by the Westinghouse Electric & Manufacturing Company has features of outstanding interest to the industry. In general, the approach to the subject of lighting is from the viewpoint of the user. Instead of discussing lighting and lighting equipment the company lays the emphasis on the user's production and operating problems, showing how they may be solved. The nature and characteristics of the various equipment used are made incidental to the question of service to be rendered.

In connection with the campaign a series of booklets announces "the way out of the twilight zone" in general industry, in aviation, in building, interior lighting and floodlighting, street lighting, show window use, etc. One special bulletin outlines the scope of the program as it applies to the various fields. Another covers general industry, showing that "on the average, each relighted factory means a yearly load increase of 5 kw. to the lines of the serving public utility." "When it is considered," the article proceeds, "that 87 per cent of all factories are in need of better lighting, the magnitude of this market is apparent."

Aviation and floodlighting

"Flying beyond the twilight zone" discusses the modern principles of and practice in airway and airport lighting. It points out the enormous possibilities latent in the field of night flying and calls attention to the rapid rate of growth in commercial flying in this country during recent months. The possibilities of floodlighting in general are shown to be almost limitless.

"Making Store Buyers Out of Window Shoppers" discusses in a clear and convincing manner the sales possibilities latent in the right type of store window lighting, coloring and display arrangement. One case is cited in which a Chicago department store raised its lighting intensity from 3½ to 15 footcandles and as a result noted a 38 per cent increase in the number of customers, an 11 per cent growth in sales and 29 per cent greater average sales. Many similar instances of increased business are outlined.

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New York Metal Prices

	Mar. 18, 1931 Cents per Pound	Mar. 25, 1931 Cents per Pound
Copper, electrolytic	10	10
Lead, Am. S. & R. price	4½	4½
Antimony	7¼	7.05
Nickel, ingot	35	35
Zinc, spots	4.35	4.30
Tin, Straits	27¼	27.05
Aluminum, 99 per cent.	23.30	23.30

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TRADE BRIEFS

Cutler-Hammer, Inc., reports for year 1930 net sales $9,342,899, profit from operations $1,531,663, other income $124,924, total income $1,656,587, depreciation $272,462, federal taxes $148,740, other deductions $45,096, net income $1,190,289, dividends $1,154,446 and surplus $35,843.

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J. W. Eshelman, Birmingham, Ala., has been appointed representative for the Northern Equipment Company, Erie, Pa., in the Alabama territory.

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Illinois Testing Laboratories, Chicago, announces the appointment of Ernest H. Du Vivier as its representative in metropolitan New York and northern New Jersey and F. W. Fernald as its representative in western Pennsylvania and West Virginia.

•

Clark Controller Company, Cleveland, Ohio, owning and operating the Sundh Electric Company, Newark, N. J., announces the opening of a district sales and engineering office, St. Louis, Mo.

•

Fuller Lehigh Company announces that the general sales offices of the company are transferred from Fullerton, Pa., to 85 Liberty St., New York. The manufacturing operations have been transferred to Barberton, Ohio.

•

At a meeting of the board of directors of the Westinghouse Electric & Manufacturing Company held this week, dividends at the rate of 2 per cent ($1) per share on the preferred and common stocks of the company, respectively, were declared for the quarter ended March 31, 1931, payable April 30, 1931, to stockholders of record at the close of business on April 6, 1931. The former dividend on common was at the rate of 5 per cent.

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Electrical Manufacturing Again Gains

ELECTRICAL manufacturing establishments were busier, on the whole, in February than in January, according to reports of energy consumption received by the ELECTRICAL WORLD, and taking into account the smaller number of working days.

The increase over January was 3 per cent. Only Washington's Birthday was counted as a holiday in this computation; if allowance is made also for some curtailment of work on Lincoln's Birthday, the increase is somewhat greater than that here shown. It will be recalled that January registered a 9 per cent rise over December, the lowest month in the present period of depression.

The slightness of the response of this industry to adverse economic conditions deserves mention. In the first part of 1930 it ran at a higher level than in 1929. The retardation was so gradual that the averages for the first nine months of both years were about equal, although 1929 had been by long odds the banner year. The monthly average was 6 per cent lower in 1930 than in 1929.

December, 1930, was only 17 per cent below the monthly average for 1929. The subsequent rise brings February within 10 per cent of the corresponding month of 1930, almost on a level with 1929 and 22 per cent above 1928.

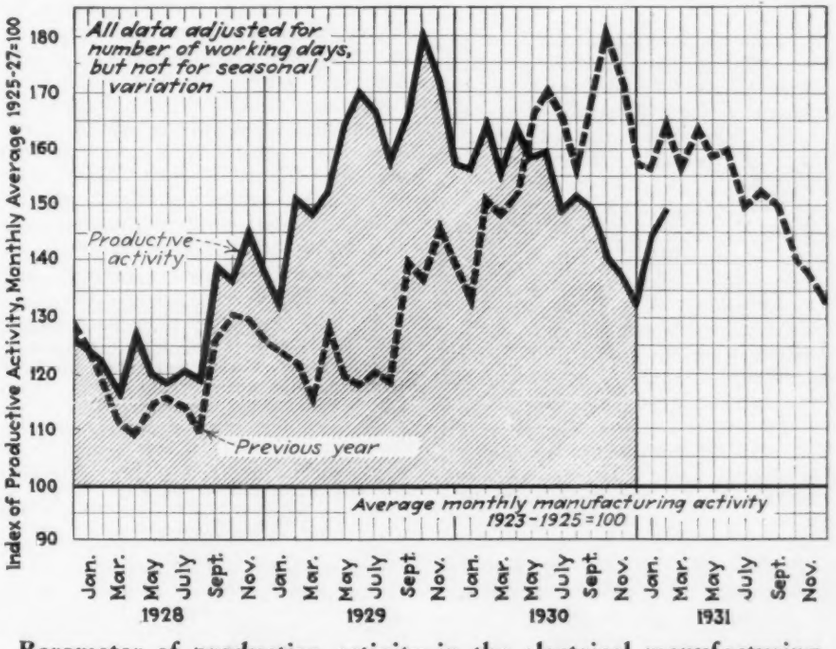
By contrast the weighted average for all manufacturing in the United States attained its high point just two years ago, drooped more rapidly in the fall of 1929, suffered another drop in the middle of 1930, and despite a rise of 11 per cent since December stood, in February, not at the level of 1928 but at that of 1923.

Compared with 1929, February was still down 10 per cent, and with 1928 down 21 per cent. In monthly average 1930 was 14 per cent below 1929 and about even with 1926.

It appears, then, that electrical manufacturing responded much later and less strongly than most other branches of industry to negative influences, but that the up-turn—so far as returns for a short period may be accepted as establishing a trend—is not correspondingly delayed.

Comparative Index Numbers

February, 1931	149.0
January, 1931	144.7
December, 1930	132.4
November, 1930	137.5
February, 1930	165.2
January, 1930	156.2
Average, 1930	150.0
Average, 1929	159.8



Barometer of productive activity in the electrical manufacturing plants of the United States

Market Conditions

EASTERN manufacturers of electrical equipment and appliances report a lull in buying after the more active business of previous weeks. New England, however, records increasing interest and a substantial number of orders. Few orders of importance have been reported from the Southeastern district, although some sizable business is in sight.

——ORDERS ARE FEW IN THE Pacific Coast area despite the number of big projects under way and the large volume of construction. Government orders are still the major part of prospective business.

▼ ▼ ▼

EASTERN

—CONTRACTS FOR ELECTRICAL *equipment are easing in Eastern district, following several weeks of expanding account, and the market has returned to that indifferent and unsatisfactory attitude that has prevailed all too long to suit manufacturers. A prominent producer believes that the lull is temporary and that the next few weeks will develop further sizable business.*

—INQUIRIES CONTINUE, *with a healthy tone both for central station and industrial equipment. Impending orders for line apparatus, including wire and cable, are promising. Electric refrigeration account is a bright spot in the situation and an important turn-over is looked for this spring. Jobbers report little change in call for electrical supplies and trade is dull.*

A total of seven bidders have tendered figures for portable electric lighting plants for the Post Office Department at South Norwalk, Conn., and Toledo, Ohio, and award will soon be made. A central station in New Jersey has placed a contract with a New York manufacturer for a quantity of cable for transmission line service, to cost about $40,000. The Bureau of Supplies and Accounts, Navy Department, Washington, will make awards for electric wire and cable, as well as insulated wire and cable, for Eastern and Western yards, for which bids have been tendered by nine different manufacturers. A contract has been placed by the Department of Commerce, Washington, with R. H. Bouligny, Inc., Charlotte, N. C., for installation of a lighting system on the Florence-Richmond section of the Jacksonville-Richmond airway, at $24,711. A New York manufacturer has secured a contract for a switchboard installation in a metropolitan office building, to cost $32,000.

Railway business continues to register substantial totals and interest is well sustained for immediate future account. General Railway Signal Company, has been awarded a contract for installation of a color light signal system on a portion of the Brooklyn and Queens subway; a contract has also been obtained from the Michigan Central Railway for installation of an automatic block signal and automatic train control system on about 115 miles of line in Ontario; still another award has been secured from the Missouri-Pacific Railway for color light signals. A metropolitan traction system has placed an order with a New York manufacturer for renewal parts for turbines and other heavy equipment, totaling $50,000.

Trade activities show encouraging development. A radio equipment manufacturer in New Jersey has secured orders for over $750,000 for high power transmission tubes for broadcasting stations, including several government contracts. A maker of electric washing machines reports business in the past four weeks the best since June, 1930. General Electric Company is advancing production schedules at its Erie, Pa., works, with employment now totaling over 6,000 men. Metal containers for electric refrigerators are being increased to a production basis of close to 4,000 units daily.

CONSTRUCTION PROJECTS

Signal Supply Officer, Signal Section, Army Base, Brooklyn, N. Y., will receive bids until April 10 for registers, thermographs, gages, clocks and other precision electrical equipment (Circular 119). American Hard Rubber Company, New York, plans addition to plant at Butler, N. J., to cost over $150,000. Nichols Copper Company, New York, contemplates a copper rod and wire mill at El Paso, Tex., reported to cost over $1,000,000. New Jersey Bell Telephone Company, Newark, N. J., contemplates an equipment storage and distributing plant to cost close to $700,000. Trico Products Corporation, Buffalo, N. Y., plans addition to automobile equipment plant to cost close to $300,000. Gulf Refining Company, Pittsburgh, Pa., plans oil storage and distributing plant at Kittanning, Pa., to cost $300,000. Purchasing Agent, Post Office Department, Washington, D. C., will receive bids until April 7 for batteries, electric cable, etc. (Schedule 6). General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until April 8 for electric motors, air compressor, rubber-insulated cable, switches, etc. (Panama Schedule 2640).

❖

NEW ENGLAND

—INCREASING INTEREST *in industrial equipment is reported in this district and orders for small motors are reported in good volume, which for the first quarter, according to reports received from representative manufacturers, will compare favorably with the corresponding period last year. Heavy electric machinery, on the other hand, is in spotty demand, though turbo-generator sales to date of one prominent manufacturer are encouraging.*

Small switch and control equipment are active. Marine sales, including small motor equipment, intercommunication service and small power generation sets are receiving attention and sales are reported in good volume. Central-station supplies are gaining in attention. Recent sales for outside control equipment reported include a number of switches and circuit breakers; increasing demand for insulators and inquiries for cable are reported. According to one jobber, new construction supplies are receiving more attention.

CONSTRUCTION PROJECTS

Lowell Electric Light Corporation, Lowell, Mass., is completing plans for an equipment storage and distributing plant to cost more than $100,000. Bureau of Yards & Docks, Navy Department, Washington, D. C., will receive bids until April 1 for a Diesel engine laboratory at the naval submarine base, New London, Conn. (Specification 6429).

❖

MIDDLE WEST

—A SLIGHT ACCELERATION *in general business in the Middle West section is noticed this week. A little greater activity is observed in most lines of industry, particularly in the steel, automotive and electrical businesses. A more general feeling of returning confidence is being expressed, and it is felt that the next quarter of the year will show a definite improvement in business.*

A considerable amount of railway purchasing of both equipment and maintenance material is going on. The advent of spring has stimulated retail sales to a certain extent. Some building construction is getting started in the suburban areas. There has been an increase in the demand for electrical apparatus, while the demand for dis-

tribution equipment has been quite steady. Some of the interesting items placed this week include transformers and reactors to cost $400,000, one single-stage, double-suction, horizontally split case centrifugal pump complete with appurtenances, three 33,333-kva. oil-insulated, self- and forced-air-cooled, single-phase 60-cycle power transformers, two 15-kv. vertical isolated-phase oil circuit-breaker equipments, and six 15-kv., 1,200-amp. single-pole, single-throw, frame-mounted solenoid-operated oil circuit breakers.

CONSTRUCTION PROJECTS

Wisconsin Valley Electric Company, Wausau, Wis., plans extensions and improvements in transmission lines, power substations and other properties to cost over $500,000. Construction Materials Corporation, Chicago, Ill., plans expansion and betterments in sand and gravel mining plant at Ferrysburg, Mich., to cost over $250,000. Rosenbaum Grain Elevator Company, Chicago, Ill., plans addition to Irondale grain elevator to cost more than $500,000, with equipment. Ruby Safety Garages, Inc., Chicago, Ill., plans multi-story service, repair and garage building to cost close to $1,000,000. Indiana State Prison, Michigan City, Ind., will receive bids until April 2 for a steam engine or turbine with generator unit, stokers, switchboard and other equipment for power plant at institution.

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SOUTHEAST

—ELECTRICAL ACTIVITIES *in the Southeast continue at the low level reported for the past two months, though a slightly more optimistic tone is evidenced. Central-station buying continues on a routine basis, with the power companies seemingly little inclined to dip into their budget funds, and while some industrial business is pending, it has not yet materialized in the form of orders.*

Merchandise activities of central stations, however, are reasonably satisfactory and show much improvement over the first two months of the year. A Georgia company ordered $22,000 in voltage regulators and a Mississippi central station purchased $12,000 worth of oil circuit breaker equipment. A Georgia company also bought $10,300 worth of bare and weatherproof copper wire last week and a Mississippi company ordered feeder regulators amounting to $10,000. A Tennessee company ordered $5,100 worth of potential transformers. Some other power company orders were for $8,800 worth of lightning arresters and oil circuit breakers and $3,300 worth of range switches. The city of Ocala, Fla., ordered 2,500 lb. of No. 6 weatherproof copper wire.

CONSTRUCTION PROJECTS

Norfolk & Western Railway Company, Roanoke, Va., will receive bids until April 1 for electrical apparatus and repairs to present electrical equipment for one year (Contract Serial AA-609). Louisville Gas & Electric Company, Louisville, Ky., contemplates extensions and improvements in plants and system to cost over $1,500,000.

❖

PACIFIC COAST

—DESPITE BIG PROJECTS *awaiting bidding or ordering, actual orders are very few and the past week has recorded hardly any noteworthy requisitions for electrical machinery or supplies. Crop prospects are excellent if vigorous marketing can prevent overproduction.*

United States government and power buying still furnish the major portion of prospective business, such as 65 lighting units for Fort Mason in San Francisco, motor-driven lathes, presses and other yard machinery for Navy Department, a $700,000 federal building for Phoenix, a $10,000,000 appropriation for Los Angeles federal building, Air Corps barracks for Honolulu and a $30,000 electric crane equipment for San Diego. Power company prospective business is announced for 20-mile tie-ins in the Gustine and Mendota districts, a carload of crossarms for Burbank and two carloads of ranges valued at $20,000 for Spokane. A three months' intensive co-operative range campaign by Pacific Gas & Electric Company is ready to begin. Industrial plant business provided a fairly bright picture the past week, including a $3,500 General Electric crane motor for San Francisco area, a $19,000 General Electric equipment for a lighthouse, and announcements of a new cement plant for Redwood City and a building stone plant for Los Angeles. Miscellaneous building construction features schools, hospitals and churches, such as a $21,000 award for a new hospital electric distribution system, two $250,000 churches for San Francisco, several $2,000 to $5,000 wiring and fixture jobs for rural schools, a $250,000 hospital for Colusa and other fairly sizable jobs which, though not spectacular in themselves, provide a fair volume. The city of San Francisco is considering an award for 140 street-lighting tops, transformers and cable, with 100 extra lights as a rider to contract.

On April 10 the Board of Public Works, Seattle, will open bids for furnishing in excess of $100,000 worth of transformers for municipal lighting department. Also 252 cable reactors. King County Commissioners, Seattle, will take bids shortly for floodlighting Boeing Field, estimated to cost $12,000. Pacific Power & Light Company will spend $135,000 during the year on improvements and extensions in Astoria, Oregon district the work including reconstruction of present high line between Astoria and Seaside costing $75,000 and an extension 30 miles long in Young's River Valley and along Newhalen Highway, costing in excess of $52,000. An expenditure of $400,000 in construction during the year by the West Coast Telephone Company in Washington and Oregon has been announced. Motor and apparatus sales last week were at absolute minimum, the motor movement reported involving about 50 machines from 25 hp. down to dealers, mills for replacements and industrials; about 25 transformers from 15 kva. down were sold. A stated contract for between 100 and 150 motors, including one 1,000 hp. and several 500 hp., will be signed this week by the Weyerhaeuser interests for a proposed pulp and paper mill at Long View, Wash.

CONSTRUCTION PROJECTS

Southern California Edison Company, Los Angeles, Calif., plans construction of transmission lines in Los Angeles and Orange Counties to cost over $1,000,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until April 14 for three transformers for the Mare Island Navy Yard, San Francisco (Schedule 538). Signal Officer, Army Corps, Presidio, San Francisco, Calif., will receive bids until April 6 for construction of an underground cable distribution system for Key line circuit (Circular 4). Pacific Gas & Electric Company, San Francisco, Calif., will make extensions and improvements in transmission and distributing lines and power substations at Redwood City and vicinity, to cost $250,000; and will carry out similar program at Lodi and Colony power substations to cost $106,000. California-Oregon Power Company, Medford, Ore., will carry out an expansion and improvement program, including hydro-electric power station and transmission line construction, to cost about $5,000,000.

❖

SOUTHWEST

—ALL OF THE LARGE *manufacturers report a slight improvement in sales to industrials. Utilities are buying in moderate quantities and the feeling is expressed that next month will show a good increase over previous months of the year.*

Several good-sized contracts are being figured and may be closed within a week. The only contract reported closed was for relays and accessories on a power plant switchboard amounting to $6,000.

CONSTRUCTION PROJECTS

Caruthersville, Mo., is arranging an election in April to approve a bond issue of $180,000, for a city light and power plant. Busch-Sulzer Diesel Engine Company, St. Louis, Mo., has plans for additions to cost over $85,000. State Prison Department, Oklahoma City, Okla., contemplates construction of a state-owned cement mill to cost $500,000. Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans extensions and improvements in power plants and system to cost over $1,000,000.

New Equipment Available

Floodlight Unit for 3- and 5-Kw. Lamps

WHAT IS CLAIMED to be the first floodlight unit designed for efficient utilization of 3- and 5-kw. lamps has been announced by the Pyle-National Company of Chicago. This new airport light has the largest reflector and lens of machine-pressed optical glass ever made in America, it is claimed, being a 36-in. rectangular divergence lens.

A battery of two to four of these projectors will produce the same general operating characteristics as a fresnel lens unit of corresponding dimensions, according to the manufacturer, yet they require no special equipment either for maintenance or for adjustment. The projector is completely inclosed, is easily mounted and requires no special housings to protect it. As it is designed to use standard 32-volt or 115-volt lamps, it operates from standard, readily available power supply without motor-generator sets or other special equipment.

▼

Flexible Guy Guard

A NEWLY DESIGNED GUY GUARD made of hot dip galvanized gage steel is announced by the W. N. Matthews Corporation, St. Louis, Mo. It may be installed from the ground without the aid of a ladder, as the only attachment to make secure is one guy clamp bolt near the ground. Rigidly bolted to guy clamp, it cannot twist or turn over with variation in tension of strand. It will go on any size strand from $\frac{7}{16}$ to $\frac{1}{2}$ in. and is visible from any direction.

There are four places where this guard may be attached to the guy clamp bolts. This provides the necessary flexibility for taking care of anchor rods that may protrude as much as 30 in. from the ground.

The guy guards are so designed that they will nest 80 per cent one within the other. This puts them in the third rate freight classification, which saves from 14 to 24 per cent all over the U.S.A. and in foreign countries. This feature saves space on line trucks and in store rooms and makes it easy to handle bundles of six.

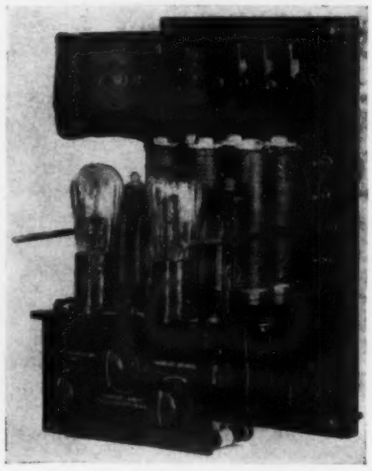
▼

A NEW LIGHT SOURCE, the 150-watt tubular bulb "Mazda" lamp with a medium screw base, has been announced by the incandescent lamp department of the General Electric Company. Its diameter is $1\frac{1}{4}$ in. and over-all length $11\frac{7}{8}$ in.; the filament, occupying the greater length of the bulb, is 9 in., a desirable lineal light source. It may be burned in either base down or horizontal position. The straight line of light produced by this type of lamp is desirable for many lighting requirements of architectural schemes, it is claimed. It is suitable for producing uniform illumination for exterior and interior opal glass panels and for luminous columns, large torchères, art galleries, transparent interior signs and large wall or floor display cases, etc.

▼

Vacuum-Tube-Equipped Automatic Synchronizer

A NEW VACUUM TUBE automatic synchronizer which has no moving parts and requires but 5 volt-amperes has been announced by the Westinghouse Electric



& Manufacturing Company. It can draw its energy from a condenser bushing and has a substantial advantage over mechanical synchronizers which, needing 66 to 150 volt-amperes, must be fed from expensive potential transformers, it is claimed.

The principle of operation involves current based on the beat frequency between the two circuits which is rectified and used to control the grids of the vacuum tubes. The two simple adjustments are made by radio-type rheostats. One changes the frequency difference at which it will synchronize (usual figure $\frac{1}{8}$ cycle), the other adjusts the angle of advance in order to allow the circuit breaker to close at exact synchronism.

The new synchronizer is twice as accurate, it is claimed, as the most skillful human operator, and should last longer, its only depreciable elements being two standard radio tubes, good for 1,000 hours continuous service.

▼

Heavily Coated Electrode for Quality Welding

A HEAVILY COATED ELECTRODE, designated type R, for quality welding has been announced by the General Electric Company. This type of electrode is composed of 0.13 to 0.18 carbon steel, covered with a heavy coating of cotton braid impregnated with an arc-stabilizing flux, and will be available in diameters from $\frac{1}{8}$ to $\frac{5}{8}$ in. by 18-in. length.

Metal deposits of this electrode will have high tensile strength and will produce a homogeneous structure, resulting in a ductile weld. This is caused by the fact that during the arc transference period the metal is in a protective atmosphere because the electrode itself burns away quicker than the coating and excludes those elements always prevalent in atmosphere which cause some undesirable results when the use of the uncoated rod is used, it is claimed.

Extreme arc stability and high arc voltages permissible from this type of electrode produce an unusually high speed of welding for certain applications, the manufacturer states.

▼

Traffic Control Timer Has Synchronous Motor Drive

A NEW TYPE of traffic control timer, incorporating, it is said, all flexibilities of the different preceding types, has been announced by the General Electric Company. Of universal application, the timer can be used at isolated intersections, for limited progressive traffic movement, non-interconnected, and for flexible progressive traffic movement in an interconnected system.

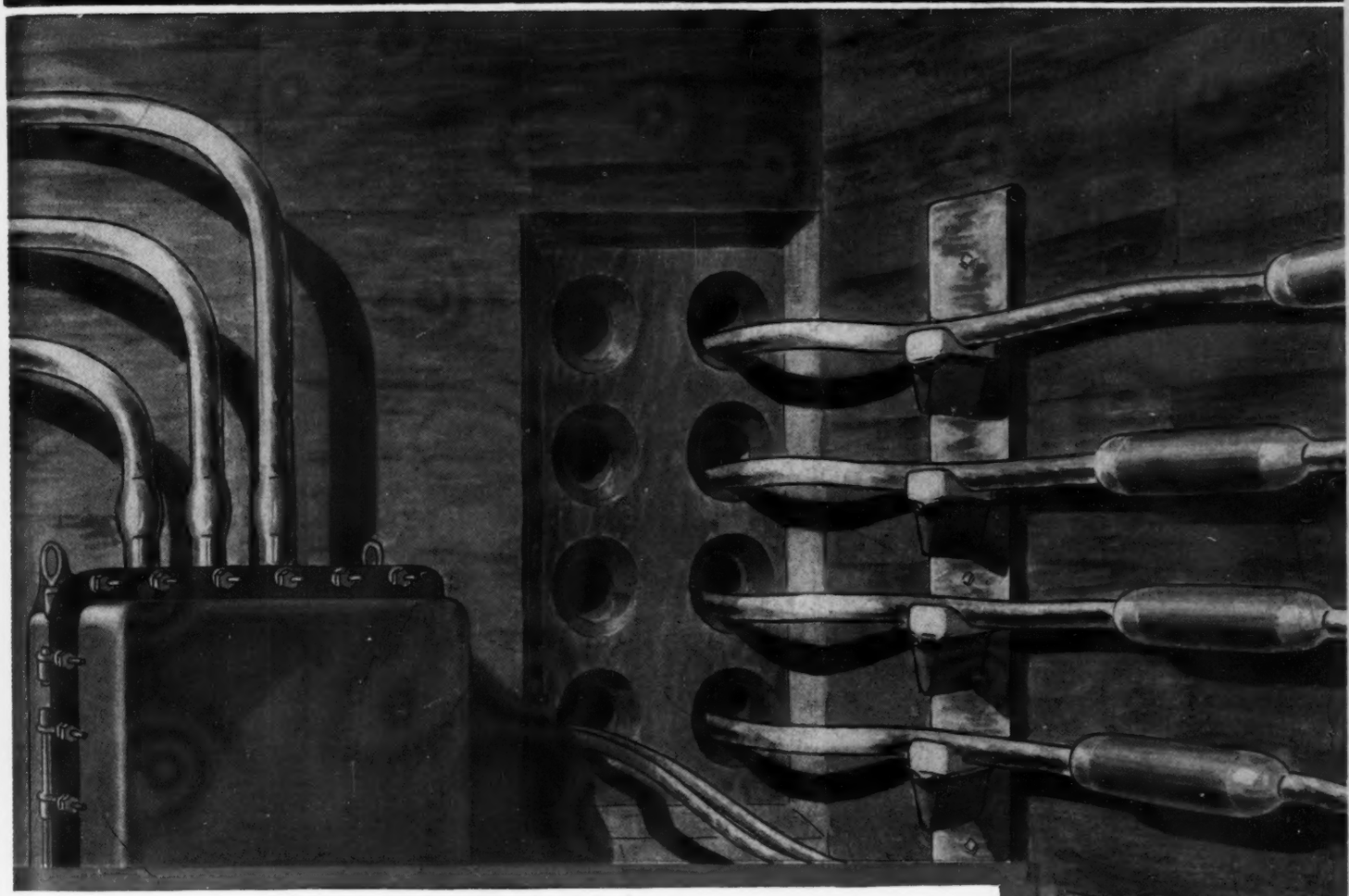
The various features in this timer include complete color sequence flexibility, local and remote total cycle adjustment, flexible push-button manual control, which prevents false indication, and triple reset.

The new unit has the cycle range of the induction timer, a new type of synchronous motor drive that is 150 times as powerful as the usual one, a fifteen-step gear shift instead of a five-step one, provision whereby it may act as a supervising control for the system, means for resynchronizing with the supervisory timer once each cycle, and provision for handling up to eight periods and nine circuits.

ELECTRICAL WORLD

McGraw-Hill Publishing Company, Inc.

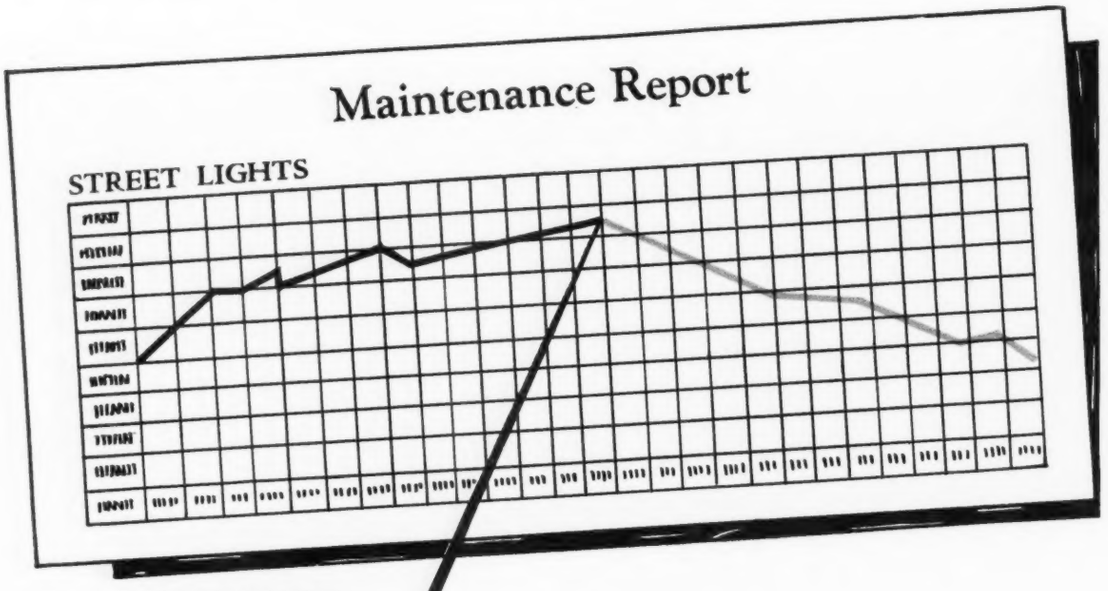
MARCH 28, 1931
25 cents per copy



Network systems have become a regular part of underground plant. OKONITE and OKONITE-CALLENDER Cables are used for every type of network installation

OKONITE

OKONITE



bought MURRAY CROWSNEST—

costs dropped at once

And the reason is plain after watching a man clean a few lamps.

One man can operate it speedily,—man shown in cut reached that height in 15 seconds after car was stopped.

Side platform available for servicing lamps that overhang sidewalk.

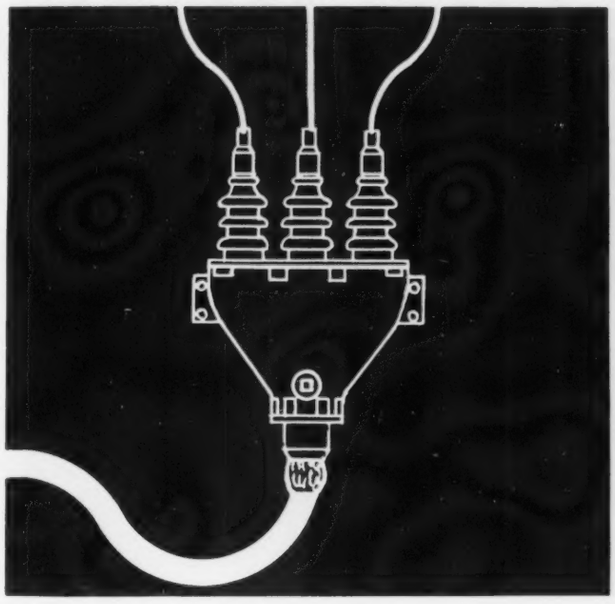
The Murray Crowsnest is economical and will reduce maintenance costs on lamp service and construction work.

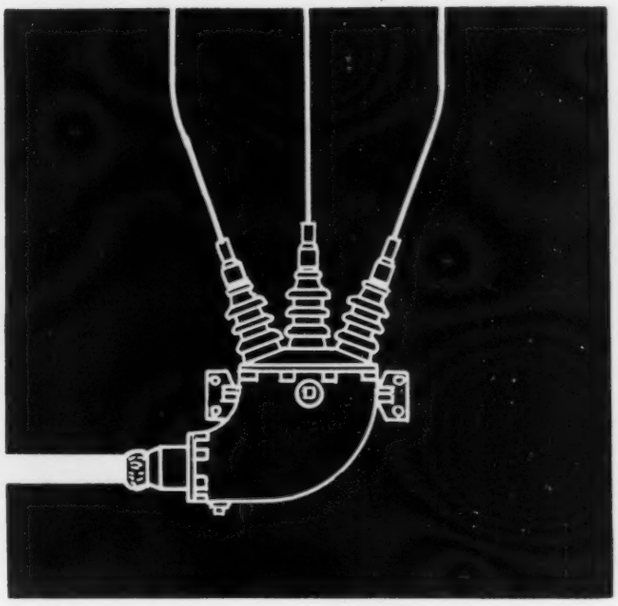
Also it is invaluable in servicing traffic lights for line work and tree trimming, for repairing trolley wires and for work on telephone and telegraph wires.

Its operation is rapid, it is safe, it is inexpensive to buy and maintenance is a minimum. Quickly mounted on a light truck. *Write for booklet.*

Metropolitan Device Corp.

1250 Atlantic Ave. **Brooklyn, N. Y.**





Does the pothead fit your job—or do you make the job fit the pothead?

WHEN you buy potheads you want more than a device to retain cable oils. G&W knows the kind of pothead you would like to have. We know what flexibility and oil-tightness means to you. We know how much you appreciate ease of installation and long life. You want a pothead you can install and forget about—until you are reminded that it has served you well year in and year out, in spite of water, heat, and ice. And in addition, you should expect such a pothead to enhance your layout—to look and perform as though it had been specifically designed for you.

THE twenty-five years we've worked on potheads have not been wasted. Many plausible ideas looked good on the board and worked well in the laboratory, but you won't find them incorporated on our potheads today. We've been in this business long enough to work out all the kinks and avoid the pitfalls. We produce excellent potheads at reasonable prices because of specialization and standardization. The former means concentration. We make, sell, think, and study potheads. Standardization is the secret of our ability to furnish 3500 kinds of potheads from stocked parts. Only large scale standardized production can give you G&W quality at G&W prices.

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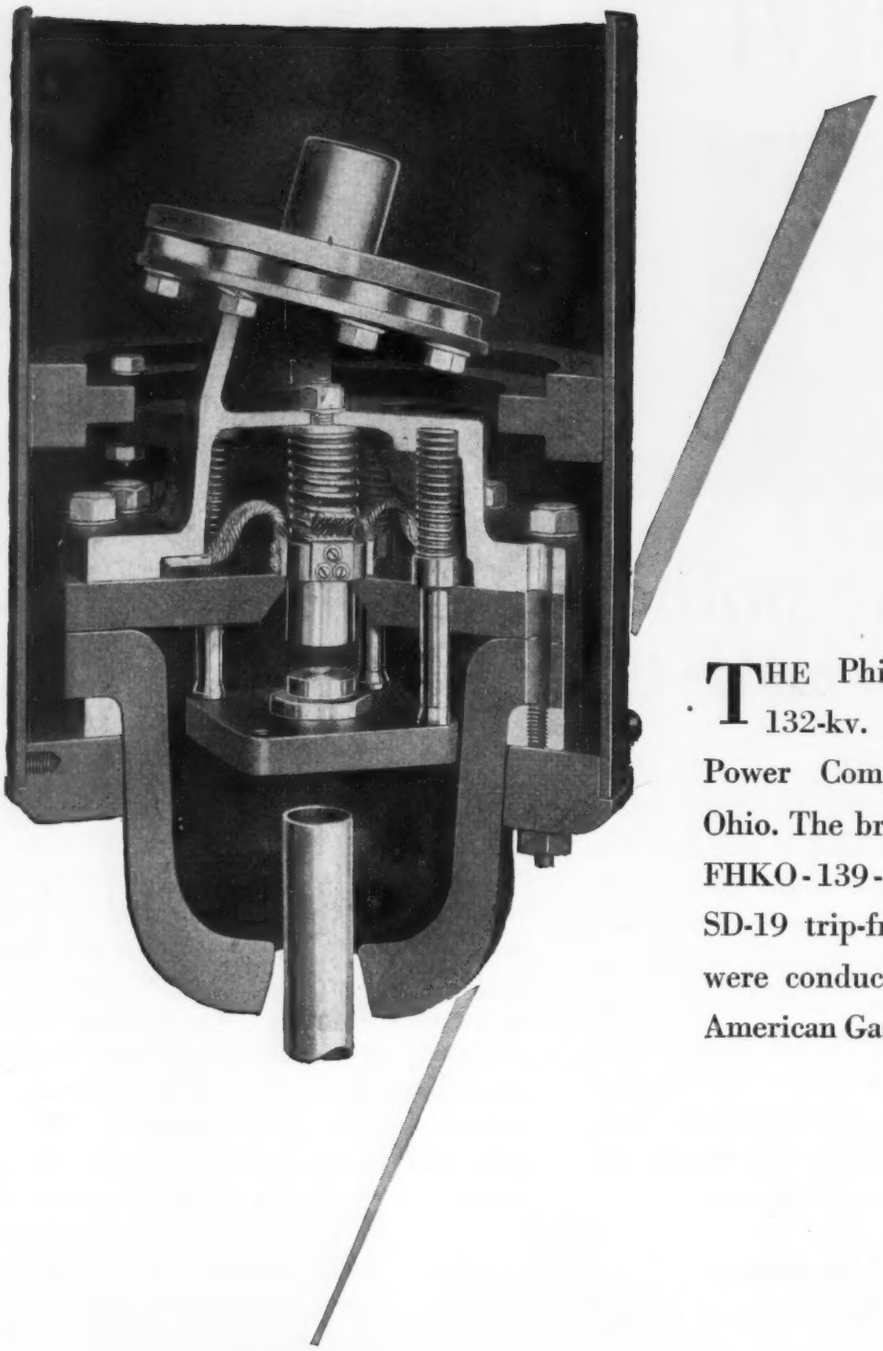
USE OUR TWENTY-FIVE YEARS' EXPERIENCE IN SOLVING YOUR PROBLEMS

OIL BLAST



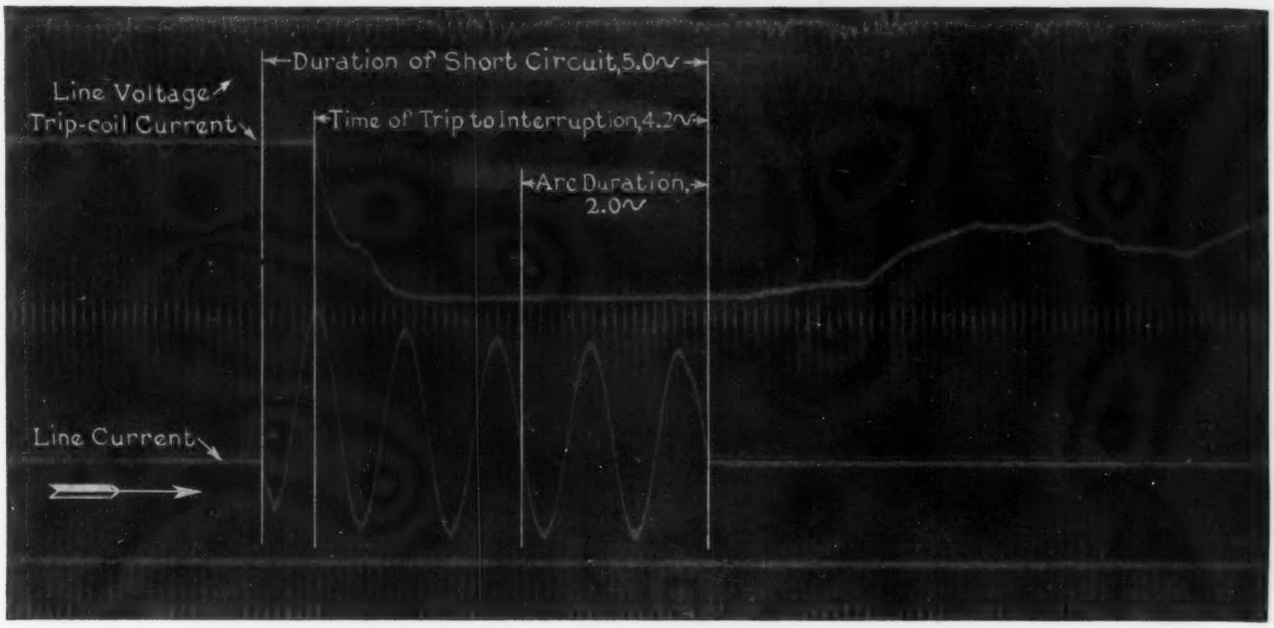
THE Philo Station is on the 132-kv. system of the Ohio Power Company near Zanesville, Ohio. The breaker tested was a Type FHKO-139-60B with a standard SD-19 trip-free solenoid. The tests were conducted by courtesy of the American Gas and Electric Company.

GENERAL ELECTRIC

SWITCHGEAR

470-22

EXPLOSION CHAMBER PROVED AT PHILO



One of the many oscillograms taken during the Philo test. It shows interruptions of 1,540,000 kv-a., which is in excess of the breaker rating. Line voltage, 140,000 volts; current, 6,350 amp.; frequency, 60 cycles

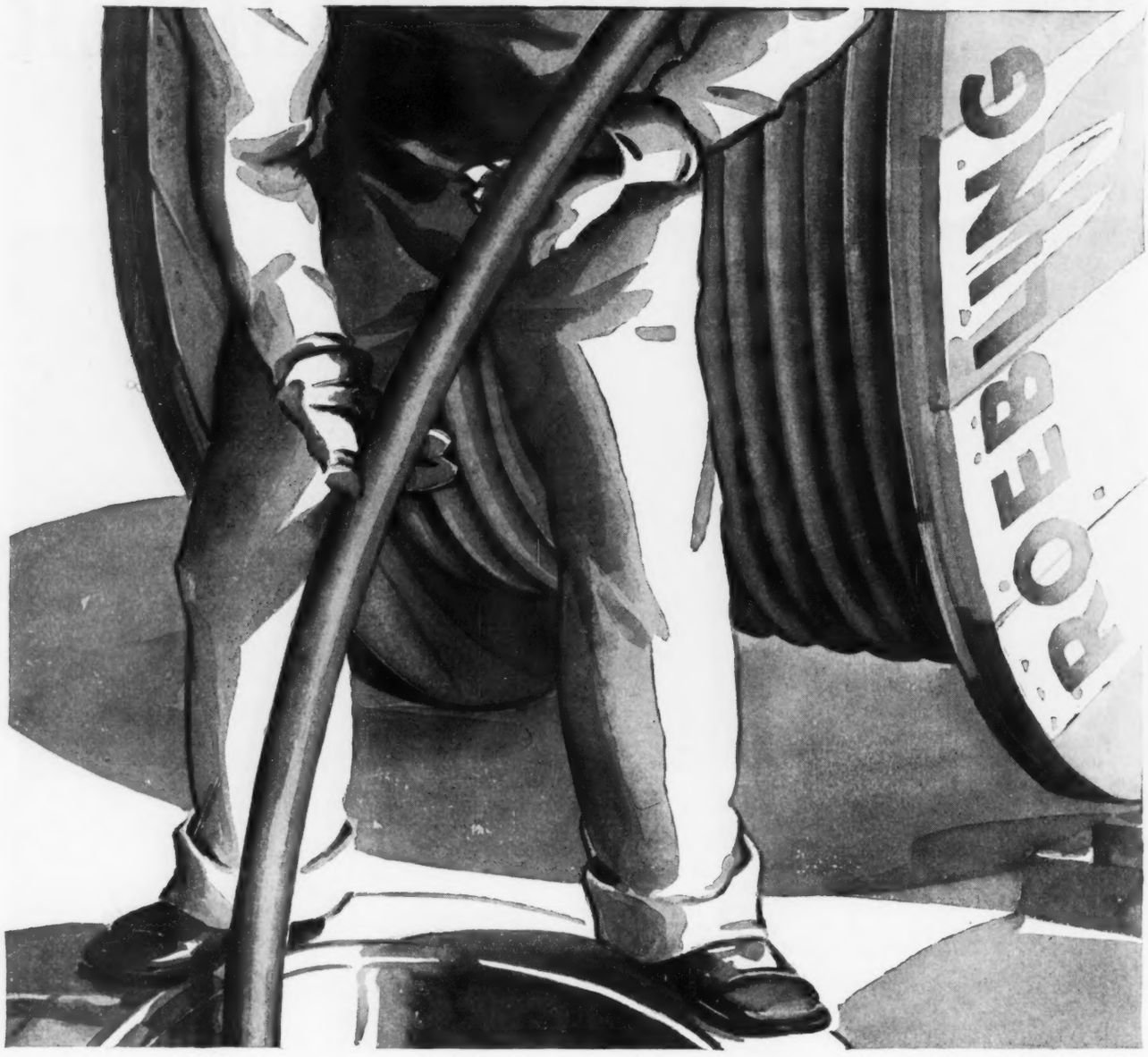
OSCILLOGRAPHIC records provide conclusive evidence that, with this important improvement, the interrupting ability of oil circuit breakers is greater than ever. The tests were made under the severest conditions of short circuit thus far created.

The average arc duration of all tests was 3.5 cycles. The average arc length was 6.8 inches. The time of breaker operation averaged 5.9 cycles. Recovery voltage was as high as 2400 volts per microsecond. Line voltage was 140 kv.

Stability is now possible on all systems because, with the new explosion chamber, there is no delay of circuit interruption. A blast of oil and the arc is out. Consider the advantages — quicker arc extinction, faster breaker operation, and consistent performance at varying currents.

Additional advantages are: complete arc confinement, small volume and effectual cooling of gases, low tank pressure, slow rate of oil deterioration, and minimum contact burning and maintenance.

JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK



ROEBLING

THERE is hardly a type of electrical wire or cable that Roebling does not make. The Roebling Line ranges from hair-fine magnet wire to heavy high tension power cable.

To provide on-the-dot service, complete stocks of all standard constructions of magnet, weatherproof, rubber-insulated and many other Roebling Wires and Cables are carried at the warehouse points listed below.

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"I'LL BET 5 to 1"

Sure, I know you—betting on a sure thing—I've lost that bet too many times to bite again—I know almost all of our trouble runs are on account of anchors pulling out—in wet weather. I wonder why they don't put in Kearney Expansion Anchors. They expand further into undisturbed soil and can be purchased for what a deadman and the labor of putting it in costs.

» » KEARNEY » ANCHORS » STAY » PUT « «

When expanded, 63% of a Kearney Hi-Tension 4-in-1 Expansion Anchor is pulling against undisturbed earth. These anchors, made in six sizes, of certified malleable iron, are guaranteed against breakage.

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☐ Send literature and miniature sample. ☐ Send a man that knows anchors.

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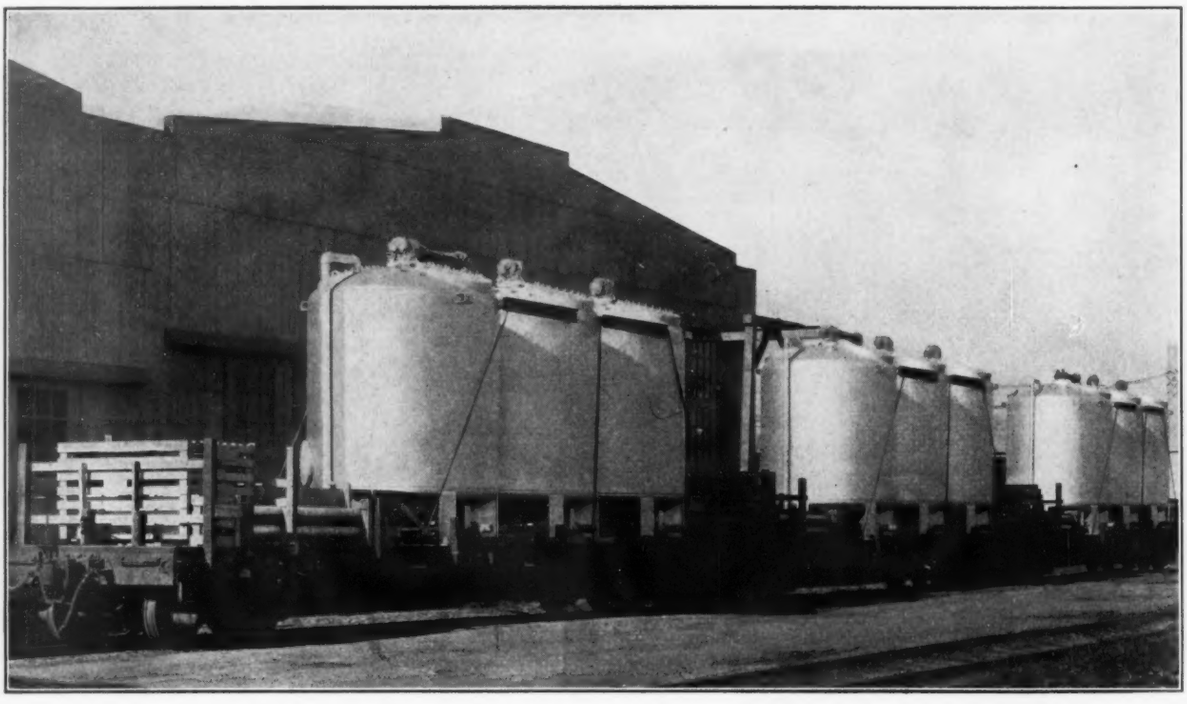
230,000 VOLT PACIFIC ELECTRIC OIL CIRCUIT BREAKERS FOR THE TIGER CREEK-NEWARK LINE, PACIFIC GAS AND ELECTRIC CO.



Three of an order of five Pacific Electric Type RW 108 Multi-Break Oil Circuit Breakers delivered on February 21, 1931 for the Mokelumne River hydro development of this large western public utility company

Pacific Electric Manufacturing Corp.

Bay View, San Francisco, Calif.

Dunes Highway, Gary, Indiana

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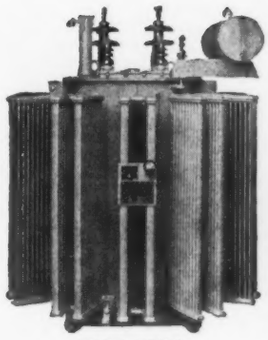
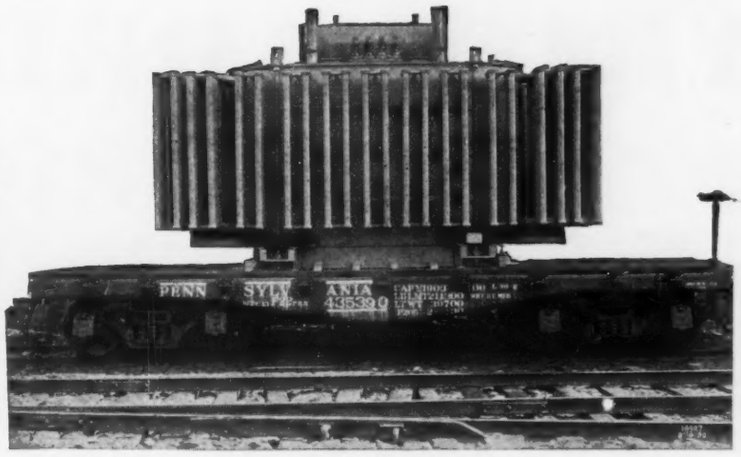
Allen Building, Dallas, Texas
H. W. Hellman Bldg., Los Angeles, Calif.
Liggett Building, Seattle, Wash.
89 Broad St., Boston, Mass.

1700 Sansom St., Philadelphia, Pa.
Dwight Building, Kansas City, Mo.
Symes Building, Denver, Colo.
Plymouth Bldg., Minneapolis, Minn.
Bedell Building, Portland, Ore.



2000 KVA.



6250 KVA., 25 CYCLES

3750 KVA.

PROGRESS

1000 KVA.

With the introduction of the new improved line of distribution transformers, Pennsylvania Transformer Company is now offering the electrical industry a complete line of transformers, from the smallest distribution size to the largest power size.

The improvements in the distribution transformers are so vital and far reaching in importance that the Electrical Engineers of many large utilities in the country class them among the greatest accomplishments in the history of the distribution transformers.

The length of life and the reliability of any transformer depend on the coil construction.

The smallest Pennsylvania Transformer now has the same coil construction as the largest Heavy Duty power transformer.

333 KVA.

100 KVA.

A glance at such a coil will readily convince you of its electrical, mechanical and thermal superiority over anything ever offered to the electrical industry.

All Pennsylvania Transformer representatives are supplied with sample coils which they will gladly submit to you for inspection.

Let your next bank of transformers have circular coils, treated in varnish, and cooled by vertical oil ducts. You will then be assured of getting the strongest and most reliable transformer on the market.

15 KVA.

PENNSYLVANIA TRANSFORMER COMPANY

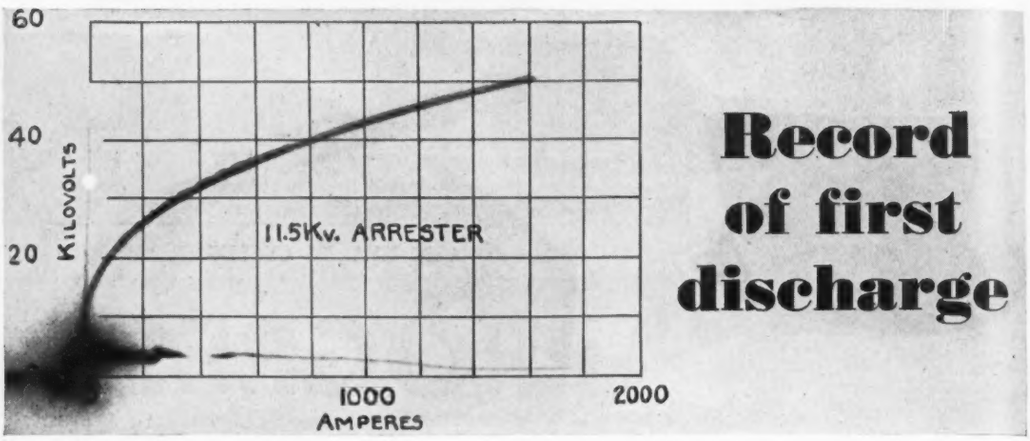
Twenty-eighth St. and A. V. R. R.

Pittsburgh, Penna.

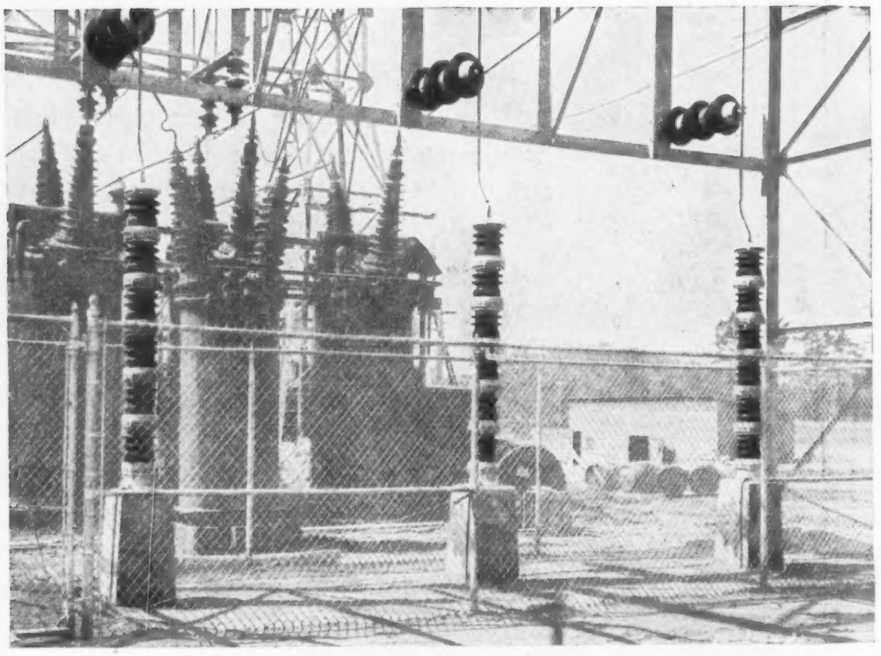
Atlanta Birmingham Boston Chicago Dallas Detroit Hartford
Indianapolis Madison Minneapolis New Orleans New York Oklahoma City Providence

THYRITE ARRESTER

Single-pole Thyrite arrester for 69-kv. system. Described fully in Bulletin GEA-1304.



Record of first discharge



Typical three-phase installation

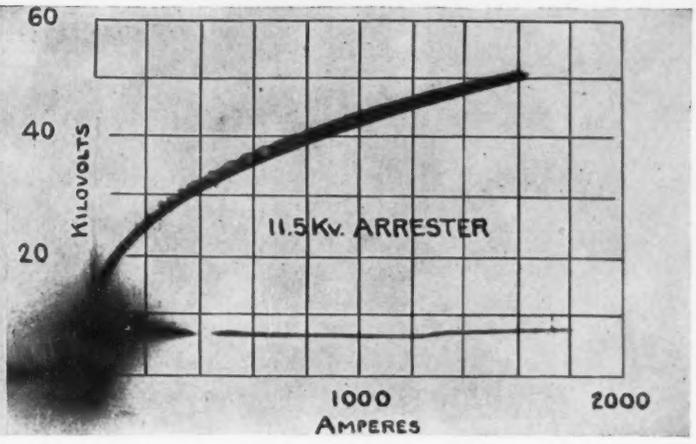
JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

PERFORMANCE IS UNCHANGING

—and after 1000* discharges



*These 1000 arrester discharges were made by superimposing an impulse current of 750 amp. on a 60-cycle power voltage of 11.5 kv., rms., applied to the arrester. The first and last discharges were made by an impulse current of 1600 amp.

INHERENT qualities of Thyrite material give unusual stability — permanence — to Thyrite station-type lightning arresters.

Thyrite is practically indestructible; it is literally "harder than a rock." Tests have shown that Thyrite is 50 per cent stronger than granite.

Thyrite will not flash over, puncture, fracture, or shatter when conducting immense currents.

Conduction of current through Thyrite is not attended by arcing, sparking, or burning and requires no air breakdown, ionization, or deionization.

Thyrite will withstand red-hot temperature, and after cooling retains its initial characteristics.

The single-line (no loop) volt-ampere characteristic of Thyrite is an unmistakable mark of stability. The current is a function of voltage only, whether increasing or decreasing, and is the same for continuous or alternating potential, slow- or fast-impulse.

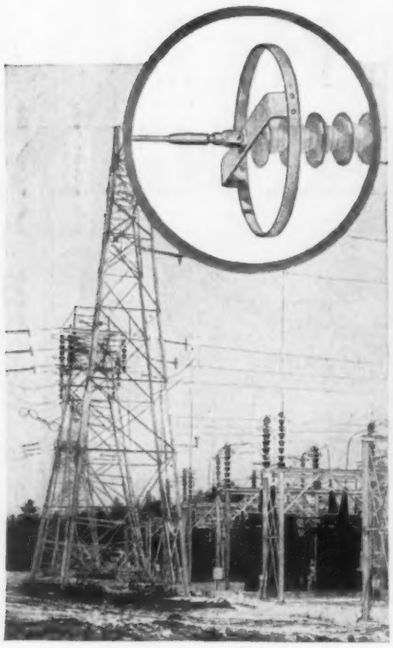
These features of Thyrite material result in arrester performance that will continue indefinitely.

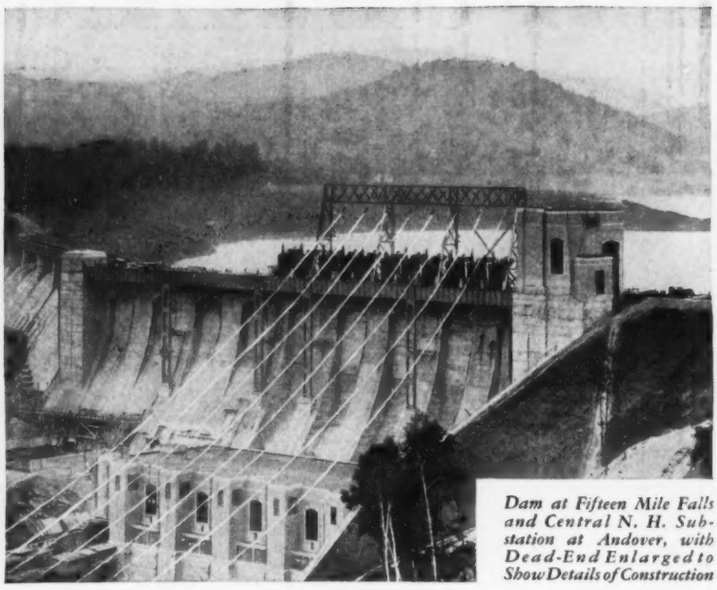
This is the fourth of a series of announcements setting forth the distinctive features of Thyrite and Thyrite lightning arresters.

440-22

ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES





Dam at Fifteen Mile Falls and Central N. H. Substation at Andover, with Dead-End Enlarged to Show Details of Construction

Typical Installation of Anaconda Hollow Conductors for Bus Structures

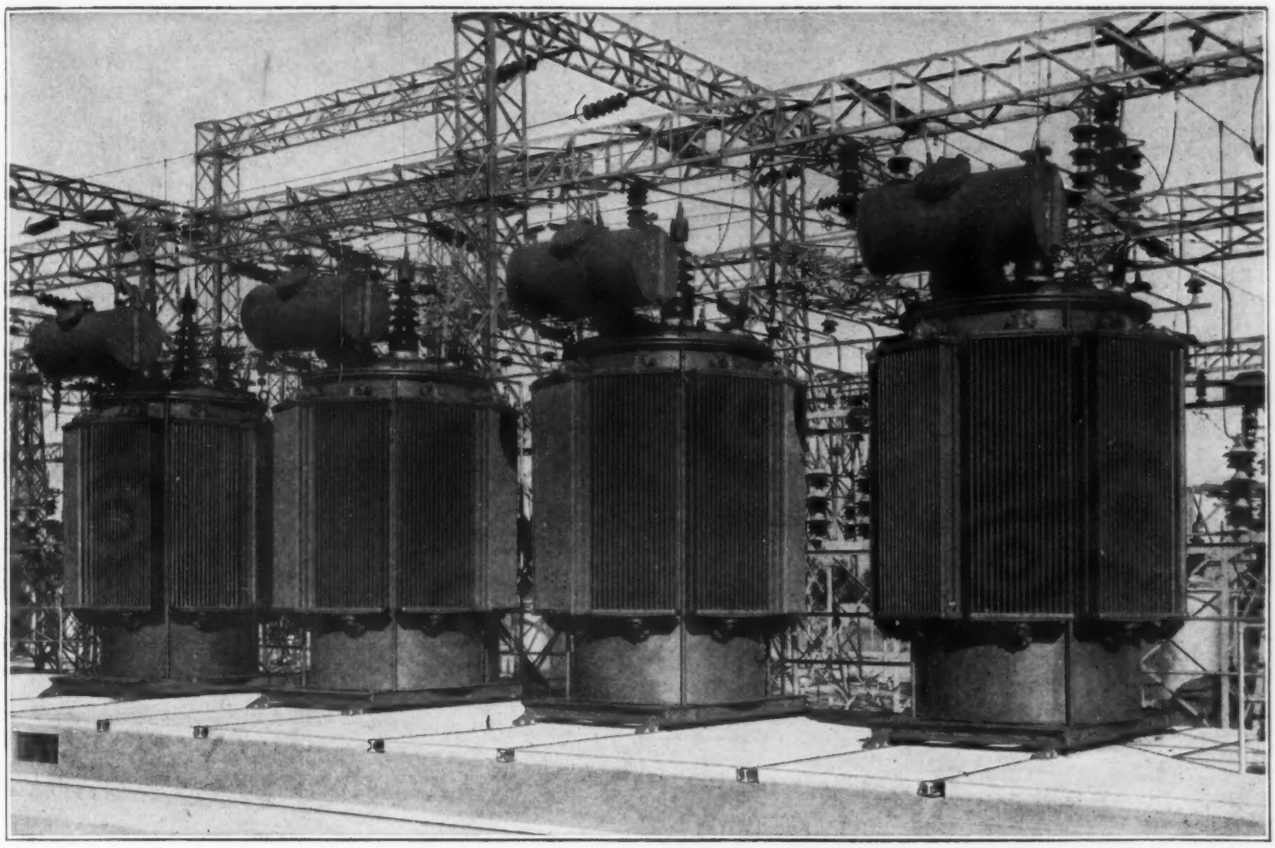
Engineers of New England Power Association used Anaconda Hollow Conductors for all 220 kv bus structures on its Fifteen Mile Falls to Tewksbury transmission line . . . On the same project Anaconda Seamless Copper Dead-end Connectors and high-strength Bronze Clevises were used throughout.

For New England Power Association . . . as for others from coast to coast . . . Anaconda has demonstrated its ability to supply wires and cables for *every* electrical requirement, including special applications.

ANACONDA
from mine to consumer

ANACONDA WIRE & CABLE COMPANY

GENERAL OFFICES: 25 BROADWAY, NEW YORK
CHICAGO OFFICE: 20 NORTH WACKER DRIVE
Sales Offices in Principal Cities



4-10000 kv-a. Auto Transformers

. . . installed at the San Bernardino substation of the Southern Sierras Power Company and used to tie-in the Southern Sierras system with that of the Los Angeles Gas & Electric Company. They have a high voltage of 120,000, and low voltage of 95,000, with a tertiary of 13,200 volts.

Auto transformers are only one of the many types of special service transformers built by Allis-Chalmers. Others include tap changing transformers for operation under load and facilitating the tying-in of one system with another, and transformers with forced air cooling to raise the capacity during periods of peak loads.

In addition to power transformers Allis-Chalmers also builds distribution, vault, subway, and furnace transformers, motors, generators, armorclad switchgear and special electrical machinery. Write for bulletins.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee

FIBREX TREE WIRE

Protects primary, secondary and arc circuits

Winter is practically over and conditions are favorable for the line-gang to make a thorough check-up of primary, secondary and arc circuits. Particularly should wires that run through trees be closely inspected for bare spots or places that are badly worn—every time one is found FIBREX Tree Wire should be spliced in.

FIBREX prevents arcing, short circuits and leakage. It presents minimum surface to sleet, wind and snow. Moisture increases its wearing qualities. It is non-inductive, will not rot and cannot rust.

FIBREX Tree Wire is making friends in every part of the United States for the lighting companies and central stations upon whose lines it is installed, because by the use of FIBREX steadier illumination is assured in the homes and on the streets.

Samples and a copy of the booklet "FIBREX Tree Wire" will be furnished on request.

SIMPLEX WIRE & CABLE Co
MANUFACTURERS
201 DEVONSHIRE ST., BOSTON

BRANCH SALES OFFICES
CHICAGO, 564 W. Monroe St. SAN FRANCISCO, 390 Fourth St.
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PHILADELPHIA, 1227 Fidelity-Philadelphia Trust Building
JACKSONVILLE, 417 Barnett National Bank Building

SIMPLEX INSULATED WIRES AND CABLES

NOW! A New and Improved AETNA RUBBER *LINEMEN'S GLOVE*

STEAM CURED

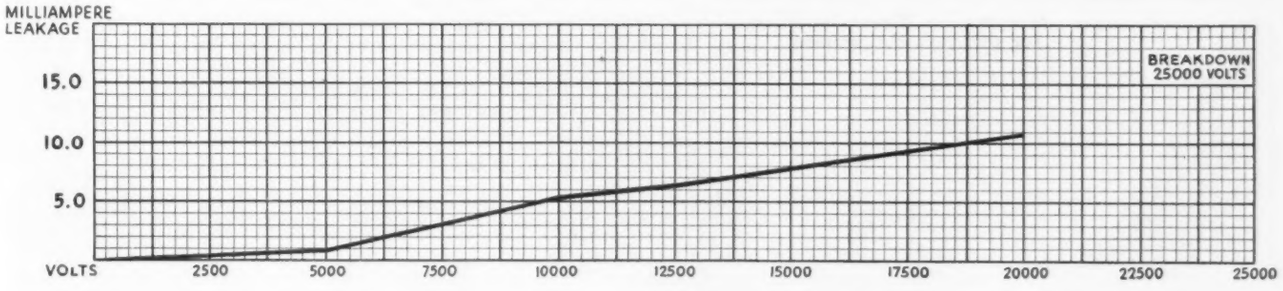
FOR

Maximum Protection
Dependability
Performance
Service

Only pure rubber, cured by steam, produces a glove that will meet the requirements of this important use. AETNA GLOVES are pure rubber, and are steam cured. Style illustrated is Class "B," our E1000. Guaranteed 10,000 volts. Intended for use under protecting leather gloves.

Made to meet N.E.L.A. Specifications

Recent test reports from The Electrical Testing Laboratories, New York City, and Public Utility Companies show the New and Improved AETNA GLOVES to withstand a much higher voltage before breakdown and a lower milliampere leakage at rated voltage, as indicated by the illustration below.



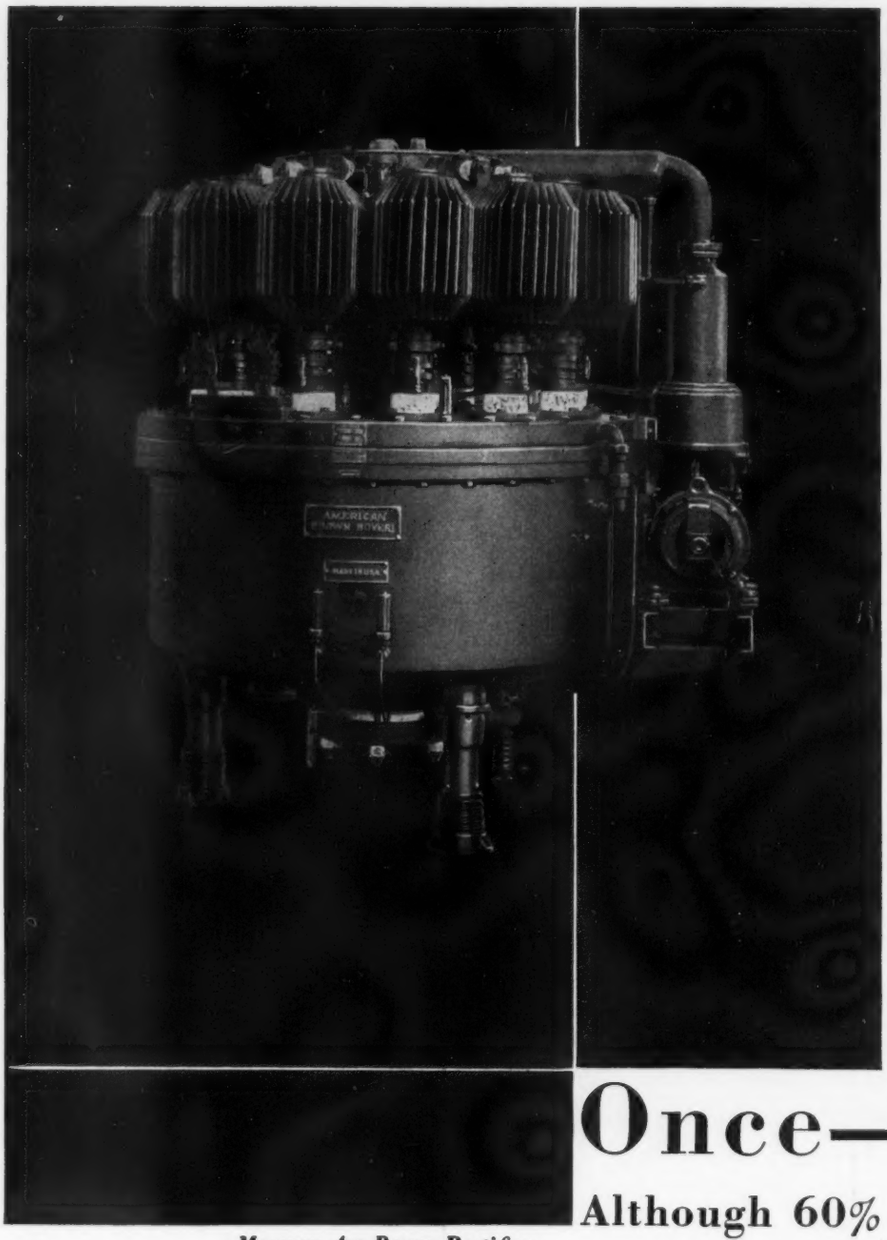
Guaranteed against defects in material or manufacture, or failure under rated voltage

WRITE FOR CIRCULAR TODAY!

THE AETNA RUBBER COMPANY

MAIN OFFICE AND FACTORY

Ashtabula, Ohio



Mercury Arc Power Rectifier for 600 volt D.C. service

Once—*always*

Although 60% of the orders for A.B.B. rectifiers in 1930 were from new users, over 72% of the capacity in K.W. was "repeat business."

New orders show confidence; repeat orders indicate satisfaction.

ABB

AMERICAN BROWN BOVERI CO., INC.
CAMDEN, N. J.

Pioneers in Mercury Arc Power Rectifiers

AMERICAN BROWN BOVERI

CLAMP NUT
CUT OFF HERE
1″/4
REMOVE INSULATION
1″/4
CONTACT SLEEVE
Moisture Proof POTHEADS
L-M Potheads are made for indoor and outdoor service, for one, two, three and four conductors and in various types to allow for mountings and applications to satisfy your special requirements.
Solderless Clamp type Pothead with internal terminal eases installation as there is no soldering required, no sweating of terminals, and no guessing when cutting cable. Write for detailed information.
LINE MATERIAL COMPANY
LINE MATERIAL COMPANY

LINE MATERIAL Co.

Main plant, S. Milwaukee, Wis., Branch plants, E. Stroudsburg, Pa., Barton, Wis., Gary, Ind., Scarboro Jct., Ont., Canada

HAVE YOU NOTICED THIS

Here Is Selective Economy*

This editorial in Electrical World recognizes a trend which Hi-Voltage Equipment Company saw coming many years ago.

We feel, however, that the editorial might be justified in covering more ground—all substations are getting better, and for two reasons—engineers are making them better and demands on them are more exacting.

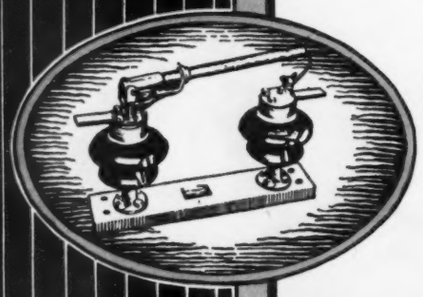
When Hi-Voltage first began making outdoor equipment years ago, we based our engineering on our belief of a coming desire for better substations.

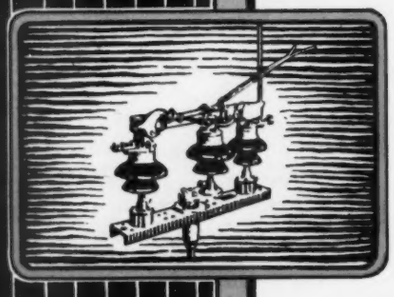
The steady increase in our business—the quick responses to each improvement we have announced, have indicated there is such a desire.

Hi-Voltage Air Break Switches—Gang Disconnects—Fuses—Bus Supports and Connectors—are built to meet your most exacting demands.

Hi-Voltage Air Break Switches, for example, always break the load—are strong, well designed to last indefinitely without attention. Monel ball and bronze race bearings make lubrication unnecessary and keep operation easy. Sleet protection has been tried and proved adequate.

All Hi-Voltage Equipment is built with that extra care which a good engineer likes to see. The cost is seldom much more.



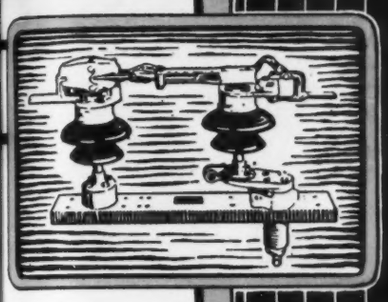


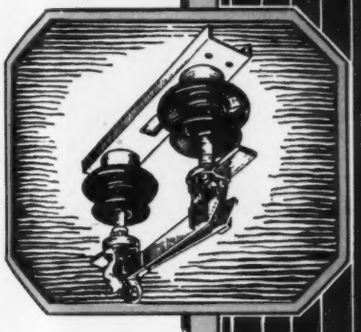
* Selective Economy—economy at those points which produce the best results over all. Switching is one of the focal points of system economy. Better switching produces startling economy.

HI-VOLTAGE

CLEVELAND

TREND?





Scientific Fuse Application

Have you seen the Hi-Voltage Fuse Charts? They permit rapid selection of a fuse link with exactly the right time characteristics. Send for a set if you do not have one.

Better Industrial Substations

A RECENT inspection of several industrial substations serving high-class manufacturing plants reveals a decided trend toward more solid electrical construction at these distributing points. The contracting engineers in each case say that their clients have come to prefer first-quality electrical service with but a minor emphasis on equipment cost. Labor expense is now so important a factor in production, despite the increasing use of marvelous machinery, that interruptions of the manufacturing process resulting from poorly planned or too hastily erected electrical installations are not to be tolerated if reasonable foresight can prevent them.

This greater solidity of construction does not mean that the industrial electrical engineer has launched upon an intellectual joy ride toward the destination of duplicated services and extreme flexibility of wiring and switching without regard to bread-and-butter needs. It does mean that the manufacturers concerned have approved a policy on the part of the electrical contractor of building for quality rather than for cheap service. There is no small amount of betterment work going forward in which old installations are being revamped to provide a comprehensive list of desiderata. This list comprises increased kva. capacity, closer regulation of voltage, improvement of power factor, increased spacings between conductors, better ventilation, selective use of transformer banks to meet changing loads, safety interlocks on gang-controlled disconnecting switches in connection with intentional phase-wire grounding, the employment of a little more rigid conduit and fittings to protect heavy conductor runs back of switchboards, the provision of suitable jacks and plugs to enable power-factor and other readings to be freely taken on particular feeders, intensive lighting of all parts of substations and the provision of disconnecting facilities to prevent spread of local disturbances.

Such improvements when carried out on a sound engineering basis cannot fairly be classed as "frills" or extravagances. In the plants scrutinized they appeared to be fully justified by their evident contribution to safer and better service.

EQUIPMENT CO.

ORANGEBURG FIBRE CONDUIT

Tested by the laboratory of actual use

FOR 37 years Orangeburg Fibre Conduit has been satisfying everyone connected with its use. As a cableway for underground electric circuits of every character Orangeburg Conduit provides a safe, uniformly round duct.

Public Utility Companies, Municipalities and all other users of underground conduit continue to find Orangeburg more than satisfactory year after year.

Orangeburg Conduit has advantages from an installation viewpoint as well. It is made in uniform five-foot lengths which are easy to handle. It is uniformly smooth and circular. Orangeburg Conduit costs less to install and never fails.

Our engineers are familiar with all problems in connection with the installation of underground electric circuits. We welcome opportunities to offer suggestions or to prepare estimates on your conduit requirements. Address Johns-Manville, 292 Madison Avenue, New York City, N. Y.

The Fibre Conduit Co.

ORANGEBURG, NEW YORK

SOLE SELLING AGENTS

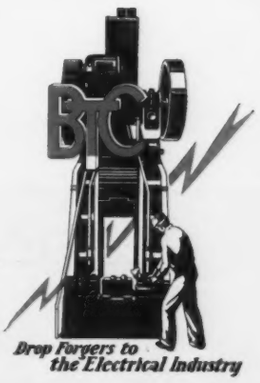
Johns-Manville

New York Chicago Cleveland
San Francisco Toronto

Successful because they are dependable

Why a Drop Forged Cap?

1. They are uniform in quality.
2. They are superior in strength.
3. They are uniform in dimensions.
4. They can be heat treated to give maximum strength with minimum weight.
5. They have precision milled joints and drilled holes.
6. They are free from hidden defects and concealed flaws.
7. They give extra protection to your lines.



Drop Forgers to the Electrical Industry

And Forgings are Dependable

Why is a drop forging dependable? Because it is uniform—because there is no danger of concealed flaws or hidden defects.

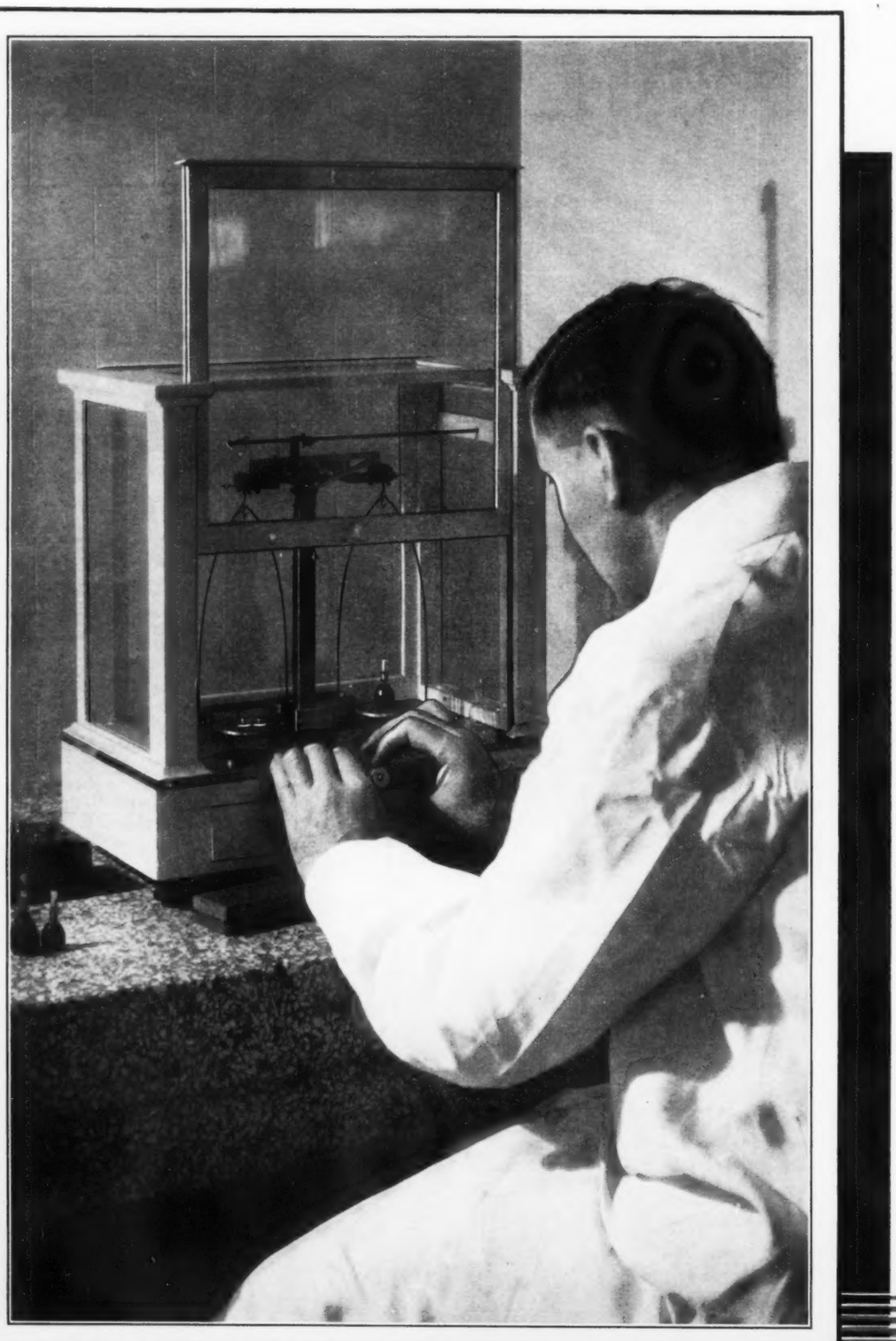
A forging has the advantage of starting production with refined steel bars. BTC drop forged high tension suspension insulator caps have the further advantage of Anti-Corrosive, 1035 Copper-Bearing steel. Once the dies are locked securely in position, accuracy is assured and the caps are hammered out in full view of the operator with no chance of *concealed flaws* or *hidden defects.*

BTC drop forged caps *are* stronger and offer machined accuracy. They are forged from the best known commercial rust-resisting metal (Copper-Bearing Steel) and hot dip galvanized to the most rigid specifications.

This extra protection; these added features have won preference and distinction for BTC drop forged caps, and Engineers the Country over are placing this added margin of safety in their specifications. Specify BTC drop forged caps for your high tension suspension insulators.

THE BREWER-TITCHENER CORPORATION
Cortland, New York

ASK YOUR INSULATOR MANUFACTURER



AT LEAST

Guaranteed

What is back of P&H PROCESS POLES

ACCEPTED standards of pole specifications are not alone the full measure of pole value. P & H Chemists and Engineers are constantly striving in the laboratory and in the field to discover new ways to raise P & H standards. To their notable contributions of the past, they have recently added a method of greatly increasing the saturation of the preservative in the groundline area of butt-treated poles.

We now **guarantee** a saturation of **at least** 36 pounds of creosote per cubic foot, to a sapwood depth of one-half inch throughout the groundline area, in addition to guaranteed one-half-inch sapwood **penetration.** This assures even longer life for "P & H PROCESS" Poles.

An exacting system of inspection, extreme care in maintaining sanitary yard conditions, the use of modern equipment for proper handling and butt-treatment, and the continuous education of skilled workmen . . . these are some of the other things we do to give you that extra value and service you get only in "P & H PROCESS" Poles.

Back of P & H Poles, also, is a Fast Shipping Service of unusual dependability on all your Cedar pole requirements—Northern White Cedar and Western Red Cedar.

PAGE AND HILL CO.

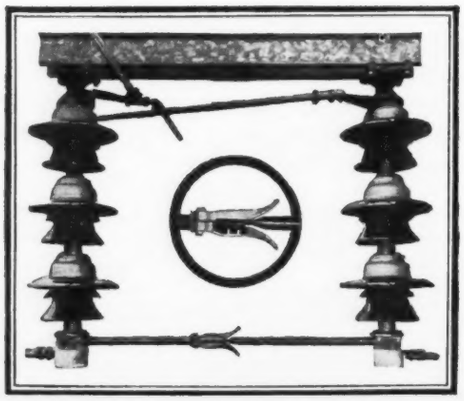
MINNEAPOLIS, MINN.

New York, N. Y., 50 Church St. Chicago, Ill., 20 No. Wacker Drive Bldg.
Boston, Mass., 733 Public Service Bldg. Kansas City, Mo., 801 Dwight Bldg.
Pittsburgh, Pa., 1210 Grant Bldg. Dayton, Ohio, 854 Reibold Bldg. Omaha, Neb., 711 Electric Bldg.

"Still in the Lead"

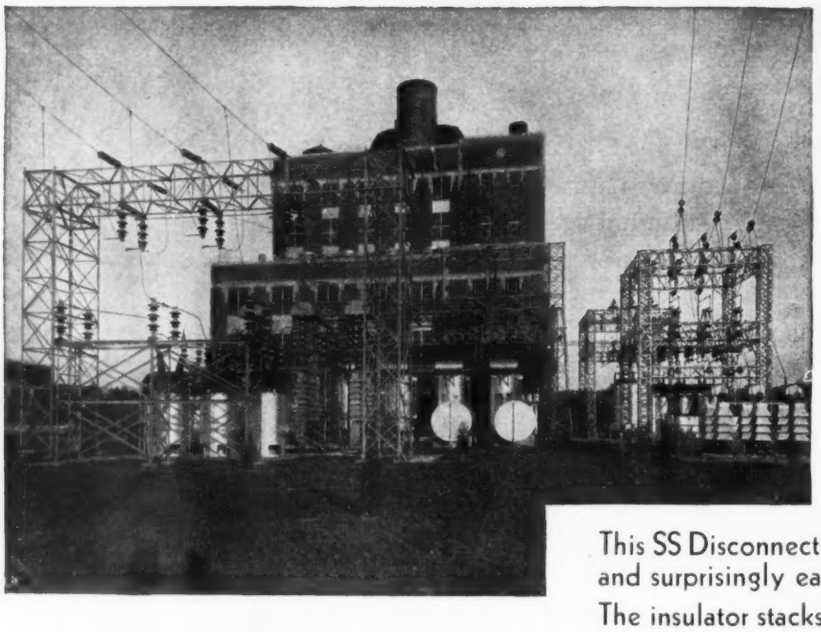
36 POUNDS

Saturation



GROUP OPERATED DISCONNECTING SWITCH

Types 107 108 109



Outdoor switching structures at new Gorgas Steam Plant, completely equipped with 115 KV and 50 KV Types 107, 108, and 109 switches.

This SS Disconnecting Switch is simple to install, rugged, and surprisingly easy to operate.

The insulator stacks of each phase rotate simultaneously, but in opposite directions. Blade and contact supports are of heavy copper. The jaw housings are combination blade guides and corona shields. All current carrying parts are of copper or bronze.

In addition to the underhung, as here illustrated, this switch is furnished for upright or for vertical operation. All parts are interchangeable and all types can be furnished with either manual or motor control.

Other SS Equipment — —

In addition to our famous Drop-Out Fuses, we manufacture a complete line of Air-Break Switches, Relay-Controlled Fuses, Automatic Line Sectionizers, Motor Mechanisms, Relays and similar electrical equipment. Domestic and foreign inquiries promptly handled.

WRITE FOR BULLETIN 360, AND PRICES

SOUTHERN STATES Equipment Company

BIRMINGHAM, ALABAMA

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106 West Third Street,
Los Angeles, Cal.

Utility Supply Co.,
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Houston, Texas.

Frank P. Withers,
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J. F. Shouse & Co.,
1197 Starks Bldg.,
Louisville, Ky.

H. Douglas Stier,
Room 711-101 Marietta Street,
Atlanta, Ga.

Equipment Sales & Engineering Co.,
220 E. 42nd Street,
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J. Parks Hutcheson Co.,
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Gough, Gough & Hamer, Ltd.,
Christchurch,
New Zealand.

Cleanliness . . .

is a strict regulation in all McFarland yards. It not only includes the ordinary precaution of removing all vegetation from under and around stored poles but every stack of poles is neatly piled—on tank creosoted skids — between creosoted upright supports.

Note the liberal clearance under pole piles, which insures free air circulation so necessary to complete protection of the poles while in storage.

This is but typical of the care taken in handling your poles before delivery that you may have the full and naturally long life in McFarland Cedar Poles.

You are cordially invited to inspect equipment, methods and stock at any of the McFarland plants.

L. D. McFARLAND CO., LTD.
General Offices
SAND POINT, IDAHO

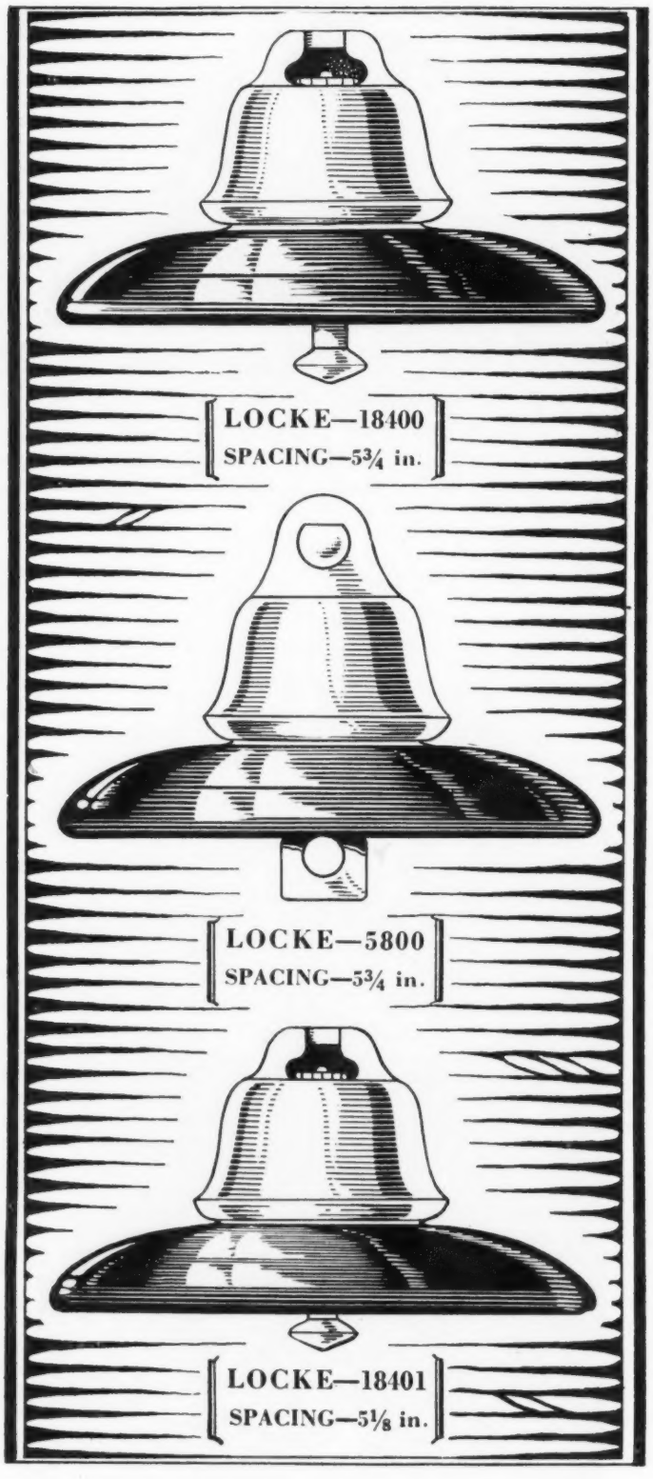
Treating Plants and Storage Yards—Minneapolis, Minn.; Sand Point, Idaho; Milwaukee, Ore. **Sales Offices**—77 W. Washington St., Chicago, Ill.; Minneapolis, Minn.; Milwaukee, Oregon.

"....but all insulators look alike"

"That's true, but insulators are like eggs—you can't judge them by appearances. Let us take just one thing as an example. For many years insulator manufacturers, including the Locke Insulator Corporation, have been applying so-called "sand" as a cement grip. Ask any insulator salesman about this and he will tell you that it is so and give you lots of perfectly good reasons for such a practice. Unsanded insulators have always been short-lived and highly erratic in performance compared with those with the sanded cement grip. This is why all modern insulators are made with sanded cement grips.

But the Locke Company goes further. Sand particles vary considerably in size and regularity. Obviously, the wide variation which, in most insulators, exists in the size of the sand grains will introduce a decided variable into the performance of the insulator. By much experiment the Locke Insulator Corporation have determined the permissible tolerances in size which will allow the insulator to develop maximum strength and maximum uniformity.

That is one of the reasons why we can offer you a standard 10" suspension insulator at an even lower price with a combined mechanical and electrical rating of 18,000 pounds—an insulator which has no rival for either strength, uniformity, or permanence."



LOCKE PORCELAIN INSULATORS

LOCKE INSULATOR CORPORATION • • • • BALTIMORE, MARYLAND

FAMOUS PROGRESSIONS IN EQUIPMENT

ONE OF A SERIES

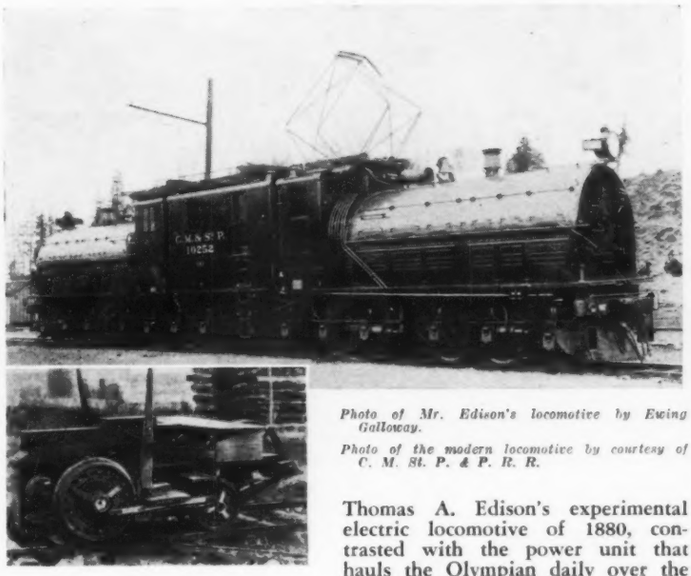


Photo of Mr. Edison's locomotive by Ewing Galloway.

Photo of the modern locomotive by courtesy of C. M. St. P. & P. R. R.

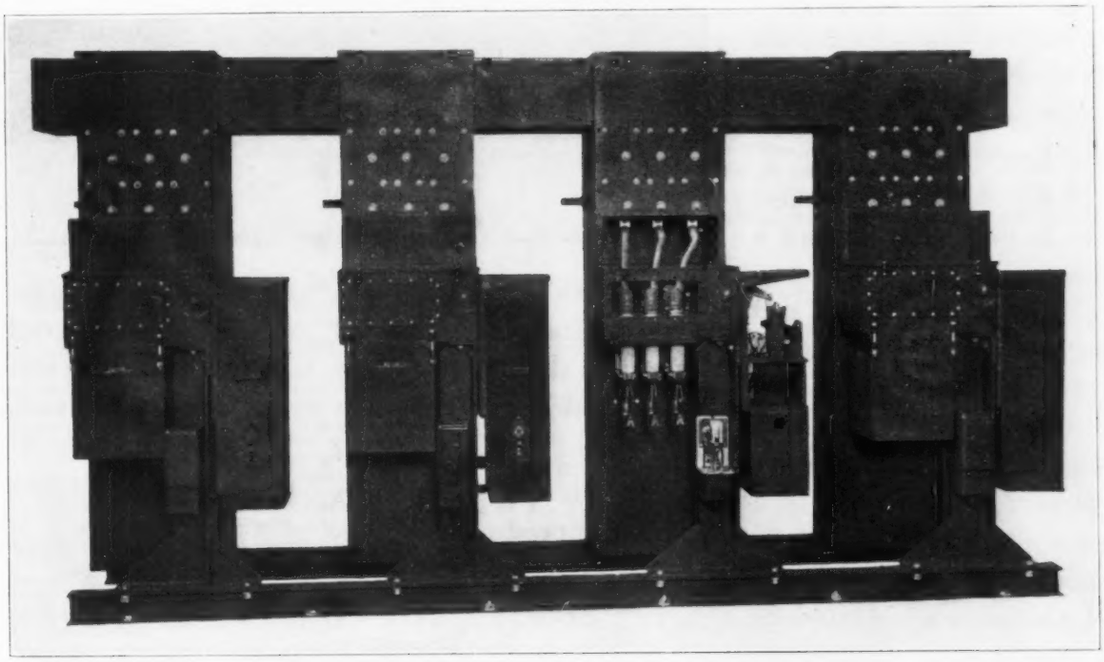
Thomas A. Edison's experimental electric locomotive of 1880, contrasted with the power unit that hauls the Olympian daily over the Rockies visualizes as few other comparisons could, the progress of electricity in transportation during a half-century.

Write for Publication No. 6

As In Locomotives So In Switch Gears

Progress in electric locomotives, great as it has been, is hardly more than a first step. Barely one per cent of steam railroad right of way has been electrified. There is but a trifle more than 45,000 miles of electric-powered right of way in the whole United States. As it gains distance we shall see locomotives that overshadow those of today as today's overshadow Edison's early experiment.

Eventually all major transportation will be by electric power and with equal certainty Delta-Star control apparatus will play a large part in it. It is the object of all railroads to arrive safely at destination on time, which presupposes certainty of operation of all equipment ——a quality that is outstanding in Delta-Star Metal Clad Switchgear.



DELTA-STAR ELECTRIC CO.

CHICAGO, ILLINOIS

2400 BLOCK, FULTON STREET

"COME HERE, COMPRESSED AIR"

—AND THERE'S YOUR "DAVEY"

Instantly on the spot

IT takes no long-distance phone call to bring your Davey Compressor scurrying to the spot where big volumes of compressed air are needed — the chances are that it's already there and waiting, but if not, its facility for quick travel will amaze you.

Your job may be located anywhere between a paved street and a mountain of virgin timber. "Davey" sets no conditions and asks no handicaps. In the majority of cases, the combined "Caterpillar"-Davey unit is ideal: it travels literally *everywhere,* operates an endless variety of tools, and leaves the Tractor free for drawbar work when air is not needed. Other tractor mountings include Fordson and McCormick-Deering; while the same excellent Compressor is furnished for trailer, skid, railroad, (any gauge) and other mountings as ordered.

"Davey" is 1931's big news in the compressor field. Air-cooled, amazingly light for its capacity, delivering really cool air which prevents carbon formation — this machine, tested for years under exacting conditions and *proved* a success, deserves your careful study.

Please send the coupon now. Attractive literature — straight-from-the-shoulder facts — will be sent you at once.

DAVEY COMPRESSOR COMPANY, INC., KENT, OHIO

Sales Representatives in All Principal Cities

The method of cooling air compressors through the use of metals of high heat conducting quality and capacity, as contained in Davey Compressors, is fully protected by patent

DAVEY COMPRESSOR CO., INC., Kent, Ohio
Send me the story of the 500 hour competitive tests in the booklet "Four Air Compressors Went to School."

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Company_____

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Post Office_____ State_____

EW 3-28

AIR COOLED AIR

DAVEY Compressors

FLEXIBILITY

FLEXIBILITY, one of the principal characteristics of the Marine Corps, is also a necessary attribute of the successful manufacturing organization. The cadence of every-day life continues to increase—the fad of today becomes the necessity of tomorrow. The public is accustomed to the acceptance of new ideas—to improved products—to better service. And the public demands their continuance. Consequently the industrial and commercial organizations that serve the consumer's needs have come to an appreciation of the necessity for flexibility.

In serving the electric light and power companies, the Kuhlman organization has seen the advantages of flexibility and has developed that quality to a high degree. This flexibility makes new ideas and improvements immediately available in Kuhlman Transformers; it also assures unusually prompt and efficient service upon special transformer requirements.

KUHLMAN ELECTRIC COMPANY
Bay City, Michigan

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Cleveland, Ohio
Public Service Supply Co.
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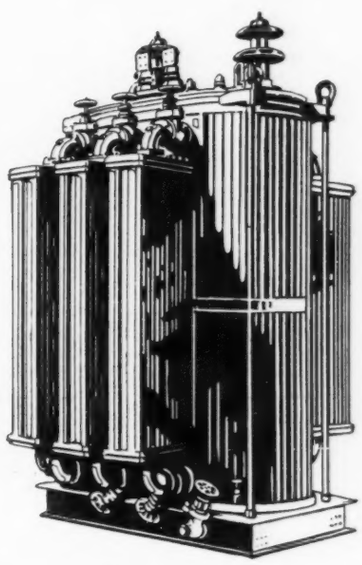
KUHLMAN TRANSFORMERS

LOW LOSSES . . . LONG LIFE



New Matthews

will save thousands of dollars for operating companies ——

Outstanding improvements over anything offered for the same purpose plus less cost installed is why, wherever shown, this new guard has won the favor of operating company officials. There is only one piece to handle and it is easily and quickly installed—this means lower installation cost; the freight cost on these guards is lower because they will nest 70%, one within the other. Read the many exclusive advantages of the Matthews Guard; try some of them and see we have been conservative in our claims.

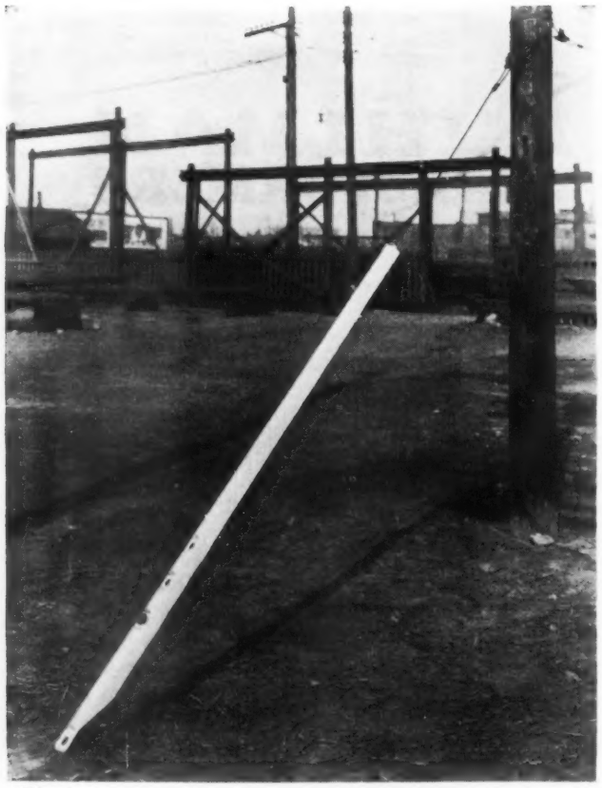
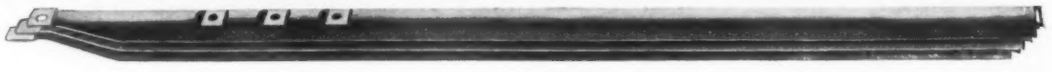


Fig. 1

Fig. 2. *Illustration below shows how guards nest*



Guy Guard

Outstanding Features

Easily and quickly installed in about one minute. •• Oval holes permit placing either head or nut of clamp bolt on top surface of Guard. •• May be installed from the ground from right or left side on any guy without the aid of ladder as the only attachment to make secure is one guy clamp bolt near the ground. See Fig. 1, 4 and 5. •• So designed that they will nest 70% — one within another. This puts them in third rate freight classification which saves from 14% to 24% all over the U. S. A. and more to foreign countries by water routes. This feature saves space on line trucks and in store rooms and makes it easy to handle bundles of six. See Fig. 2. •• Rigidly bolted to guy clamp, cannot twist or turn over with variation in tension of strand. •• Rigidly and automatically clamps strand at upper end of guard. Will go on any size strand from 5/16 to 1/2 inch. •• Will not slip up or down on the guy if hit by vehicle. •• Full visibility from any direction. Front view three inches, side view two and one-quarter inches, diagonal view two and three quarter inches. •• There are four places where this guard may be attached to the guy clamp bolts. This provides the necessary flexibility for taking care of anchor rods that may protrude as much as 30 inches from the ground. See Fig. 1 and 6. •• Only touches guy wire at one point. This eliminates vibration, wear and noise. •• Made of hot dip galvanized No. 14 Birmingham gauge steel.

Fig. 3
Shows a close-up of the automatic grip at upper end of Guard after being turned at an angle of about 45° to the strand.

Fig. 4

Fig. 5

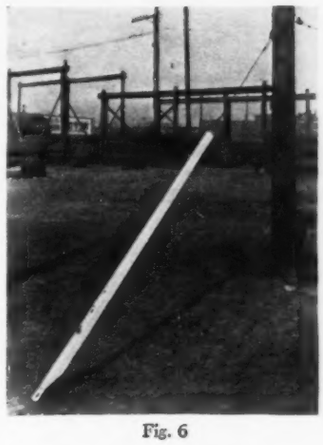


Fig. 6

W. N. MATTHEWS CORPORATION
GG-2
Engineers and Manufacturers • • • **St. Louis, Mo.**

*TERMINAL HEADQUARTERS

SHERMAN Standard Soldering Lugs

The practical thing is to standardize on this line

TWO HOLE PAT. APP.

CENTER FORMED PAT. APP.

ANGLE PAT. APP.

Sherman Soldering Lugs are approved and listed by the Underwriters' Laboratories. The requirements are very exacting and our designs and dimensions have been carefully worked out to secure rating as approved fittings. Underwriters' approval furnishes absolute guarantee of efficiency.

All round end Sherman Lugs smaller than 15/16 in. O. D. are made under the Sherman Patent and are the type which has secured great prominence. In appearance they are superior to any others. They are absolutely seamless all around. The solder cannot leak out at closed end, making messy job and wasting solder. Better conductivity is also secured. The seamless lugs are much more satisfactory than old style made from tubing. We strongly recommend use of round end lugs in small sizes whenever possible. They are better and more economical. Careful analysis shows that the use of square end lugs is usually a custom and not a necessity. However, square end lugs can be furnished if necessary.

Our line of lugs is complete—there is a type for every need.

Samples furnished. A charge is made for the large sizes but credit is given if returned.

We also make SHERMAN Heavy Duty Soldering Lugs

They are reliable, durable, and made free from the faults that are proving so troublesome in ordinary lugs. Smooth, uniform, and practically designed. You get better conductivity. Seamless extra heavy copper tubing is used. This complete line gives you adequate size, weight, and strength. Contact surfaces are flat

H. B. SHERMAN MFG. CO.

BATTLE CREEK

MICHIGAN

*HEADQUARTERS FOR TERMINALS

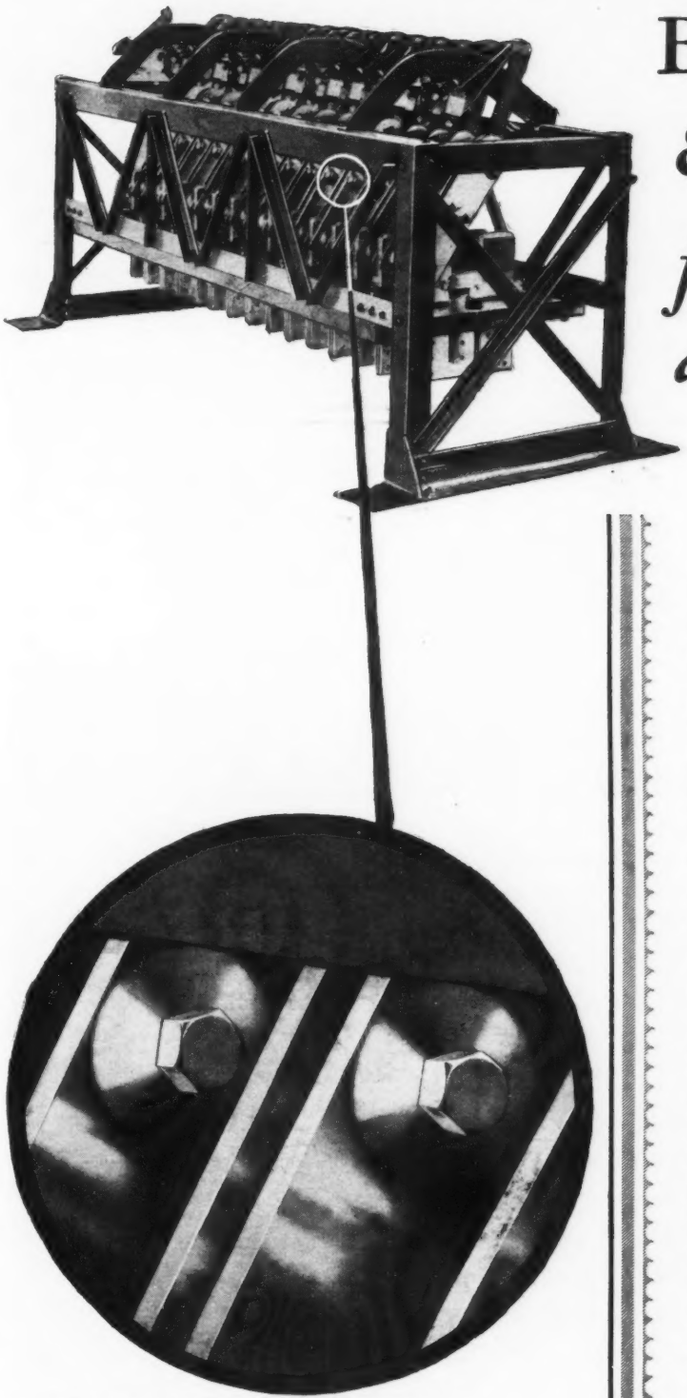
Sherman makes a high quality, complete, and economical line of terminals for the ends of the cables and wires. They are now generally accepted as the proper terminals to use because of their exclusive advantages and economy.

Ask for descriptive literature

USE EVERDUR

BOLTS, NUTS & WASHERS

for high-amperage apparatus



REG. U. S. EVERDUR PAT. OFF.

EVERDUR is an exclusive Anaconda alloy of copper (96%), silicon and manganese. It possesses high strength, high fatigue limit and great resistance to corrosion. In the form of bolts, nuts, washers, rivets, clamps, turn-buckles, etc., Everdur is widely used in electrical apparatus under the most severe conditions of climate and mechanical stress.

The bus sectionalizing switch illustrated is the product of Electrical Engineers Equipment Co., Melrose Park, Ill. Bolts, nuts and washers in the current-carrying parts are of Everdur Metal—further illustrating the increased recognition given Everdur by the electrical industry.

Everdur Metal is made by The American Brass Company chiefly in such commercial forms as sheets, wire, rods, tubes, etc. Names of fabricators making and stocking specific forms of Everdur Metal for outdoor service will be furnished on request. For detailed information, write for Publication E-2, Sixth Edition.

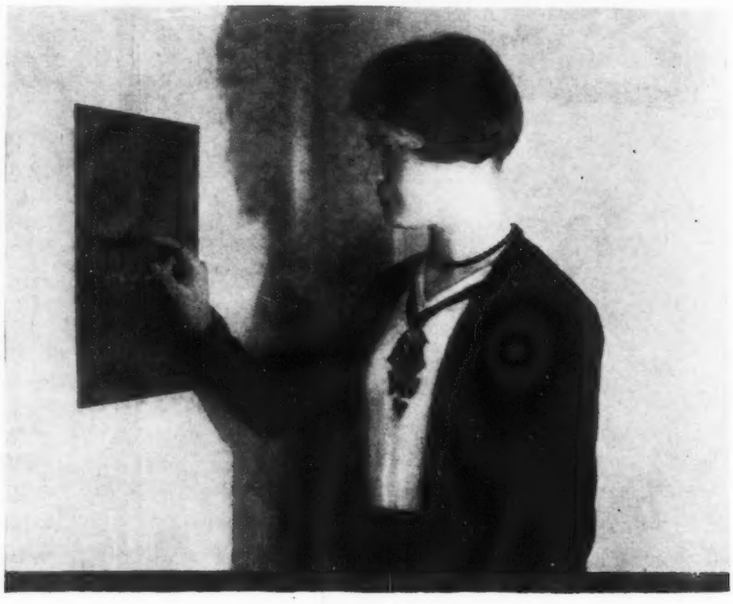
Special 10,000 ampere, 3 pole bus sectionalizing switch for 440 volt, 60 cycle service. All bolts, nuts and washers in the current-carrying parts are of Everdur Metal. Manufactured by Electrical Engineers Equipment Co., Melrose Park, Illinois.

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Canadian Mill: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

ANACONDA COPPER & BRASS

Fuse replacement costs mount with the load...unless

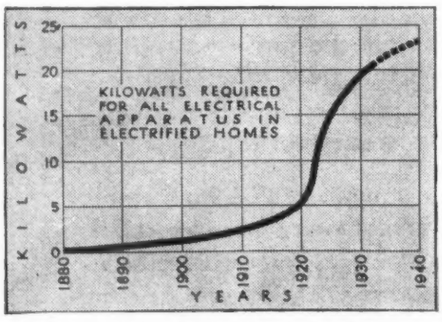
FLIPONS *guard home circuits*



Flipons are as easily operated as a wall switch.

EACH year new electrical appliances for the home add desirable load. But as this load increases, fuse replacement costs mount too . . . unless Westinghouse Flipons guard the home electrical circuits. Thirty or forty thousand dollars (such as two prominent utilities spent in 1930) is entirely too much to pay for service restoration . . . when with Flipons the housewife can restore service by a flip of a handle.

Flipons can be operated as easily as a wall switch. All that is necessary to restore service is to move the handle to the extreme "off" position to re-latch the mechanism, then throw it "on". Their desirable time-lag characteristics avoid unnecessary interruptions on slight momentary overloads. They are tinker-proof and protect the wiring at all times and under all conditions.



This curve of the increase in the possible electrical load in the home shows why fuse replacement costs are mounting.

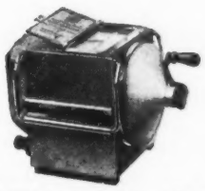
Have a specialist show you a No-fuze Load Center equipped with Flipons. Test it . . . get complete information . . . then you'll see why several light and power companies are insisting that circuits be protected by Flipons.

Service, prompt and efficient, by a coast-to-coast chain of well-equipped shops

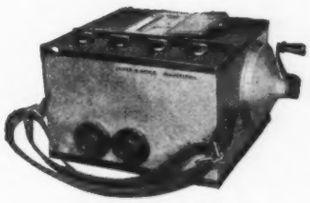
Westinghouse

T 31757

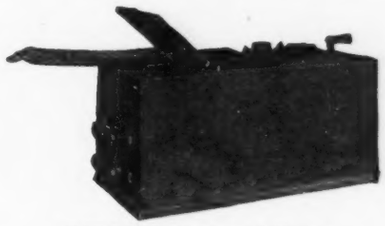
TUNE IN THE WESTINGHOUSE PROGRAM OVER KDKA, KYW, WBZ AND ASSOCIATED N. B. C. STATIONS SUNDAY EVENINGS.



"MEG" Insulation Tester
Ranges up to 100 megohms, 500 volts.



"BRIDGE-MEG"
Resistance Tester
Range .01 ohm to 100 megohms.



"MEGGER" Ground Tester
for testing the resistance to earth of installed ground connections.

1000-Volt
"SUPER-MEG"
Insulation Tester
Range 0 to 200 megohms.

"MEGGER"

TRADE MARK REGISTERED U.S. PAT. OFF.

INSTRUMENTS

Self-contained, simple to use and rugged

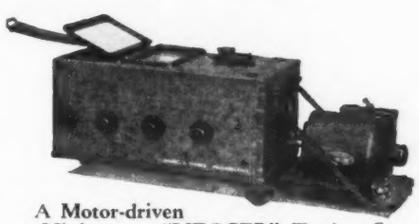
For a Wide Variety of Resistance Testing

Standard
High-range
"MEGGER" Testing Set
Ranges up to 10,000 megohms.

MANY problems of electrical testing are most conveniently met by using "Megger" instruments; various types are available to meet different needs.

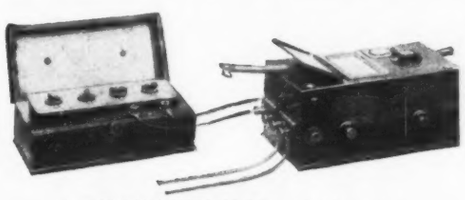
We invite inquiries from engineers who know just what to use as well as those who have testing problems in the solution of which our experience might be helpful.

For example, "Megger" instruments are used—
- —for "Megger" tests of insulation resistance
- —for "Megger" tests *and* conductor resistance tests
- —for factory production tests of insulation resistance
- —for factory tests of conductor resistance
- —for testing low resistance down to one-millionth of an ohm
- —for testing the resistance to earth of ground connections



A Motor-driven
High-range "MEGGER" Testing Set

Appropriate literature will be mailed upon request.



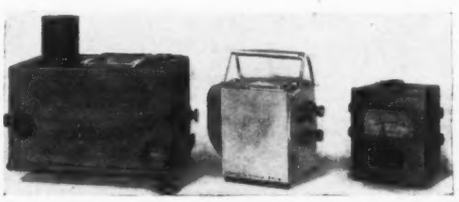
"BRIDGE-MEGGER" Testing Set
Ranges from .01 ohm up to 2000 megohms.

JAMES G. BIDDLE CO.

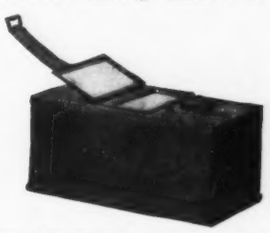
ELECTRICAL INSTRUMENTS

1211-13 ARCH STREET PHILADELPHIA, PA.

AT Philadelphia headquarters we maintain a working exhibit of our instrument specialties and welcome interested visitors during office hours.

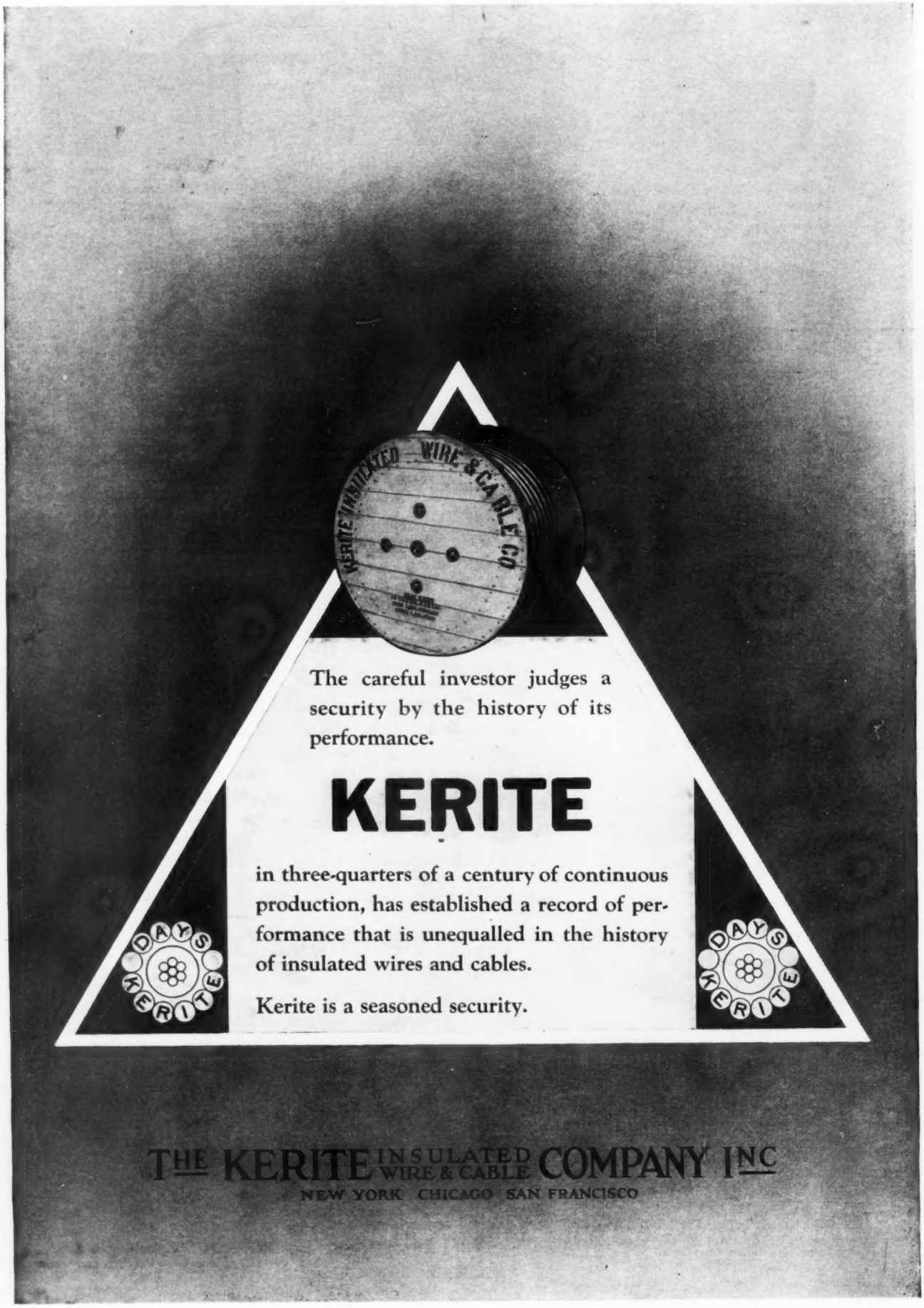


"MEGGER" and "MEG" OHMMETERS
for factory production tests of conductor resistance and insulation resistance.



"DUCTER" Low-Resistance
Testing Set
Range .000001 to 1 ohm.

"DIONIC" WATER TESTER
for testing condenser leakage and water purity.


KERITE INSULATED WIRE & CABLE CO
The careful investor judges a security by the history of its performance.
KERITE
in three-quarters of a century of continuous production, has established a record of performance that is unequalled in the history of insulated wires and cables.
Kerite is a seasoned security.
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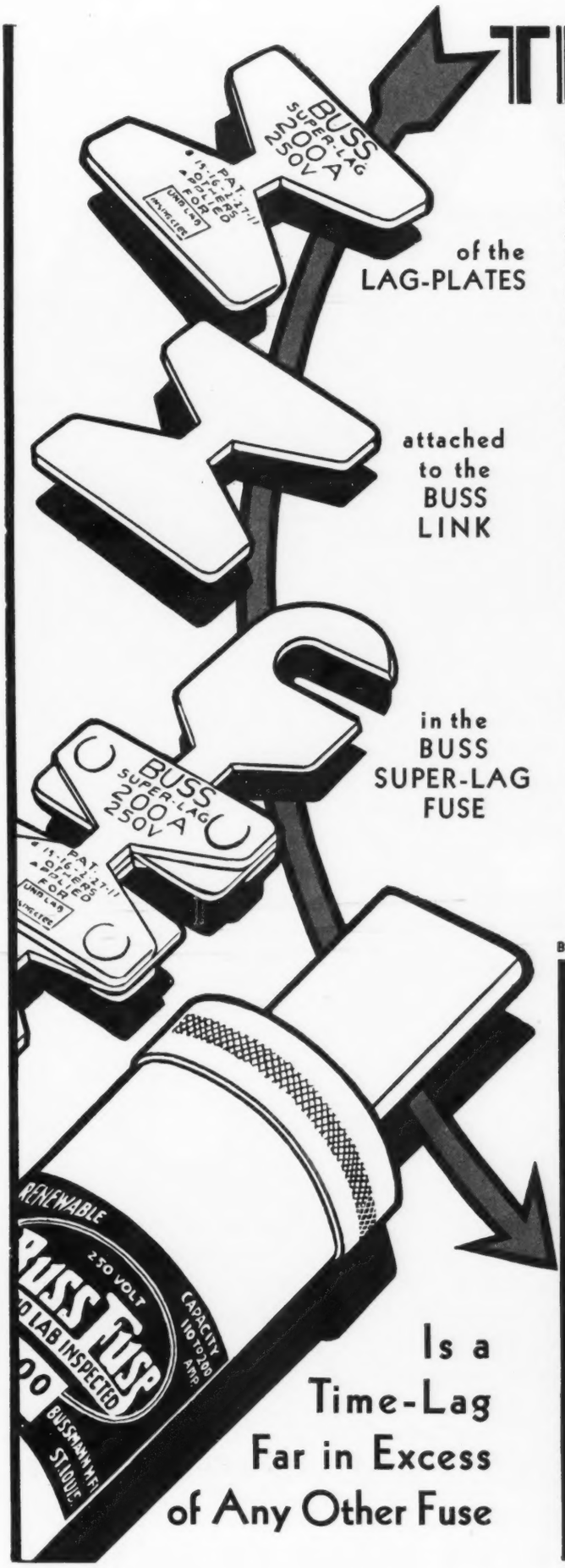
THE KERITE INSULATED WIRE & CABLE COMPANY INC
NEW YORK CHICAGO SAN FRANCISCO

THE RESULT



of the LAG-PLATES

attached to the BUSS LINK

in the BUSS SUPER-LAG FUSE

Is a Time-Lag Far in Excess of Any Other Fuse

ESTIMATING the cost of a *useless shut-down* at the lowest possible figure and multiplying it by the number occurring during a year, it will generally be found that these losses amount to more than the annual bill for fuses and renewal links. This being the case, using fuses that permit useless blows is costly and wasteful even though such fuses were given to the user absolutely free. The cost and losses due to *useless shut-downs* is undoubtedly the biggest part of the total cost of fuse protection.

Glance at the comparison chart. With such a Super Time-lag is it not apparent that the RESULT of using BUSS SUPER-LAG Fuses will be the most dependable protection at the lowest cost?

Get More Facts If You Want Them

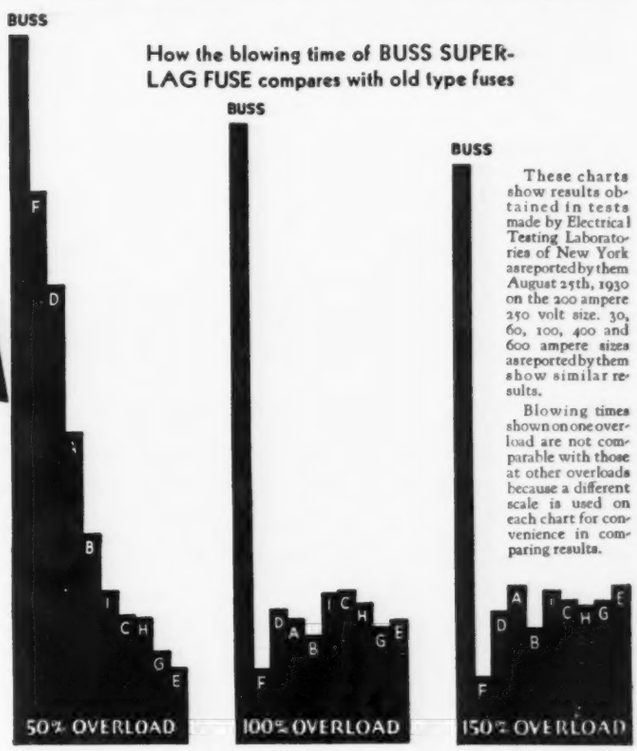
Just because fuses may be a "small item of purchase" don't delay. Fuseing costs, as seen, are governed by fuse performance—not by invoice price.

Should you want more data for yourself or additional information to pass along to other men in your establishment, drop a line in the mail today.

BUSSMANN MANUFACTURING CO., ST. LOUIS, MO.
A Division of the McGraw Electric Company

BUSS SUPER-LAG FUSES

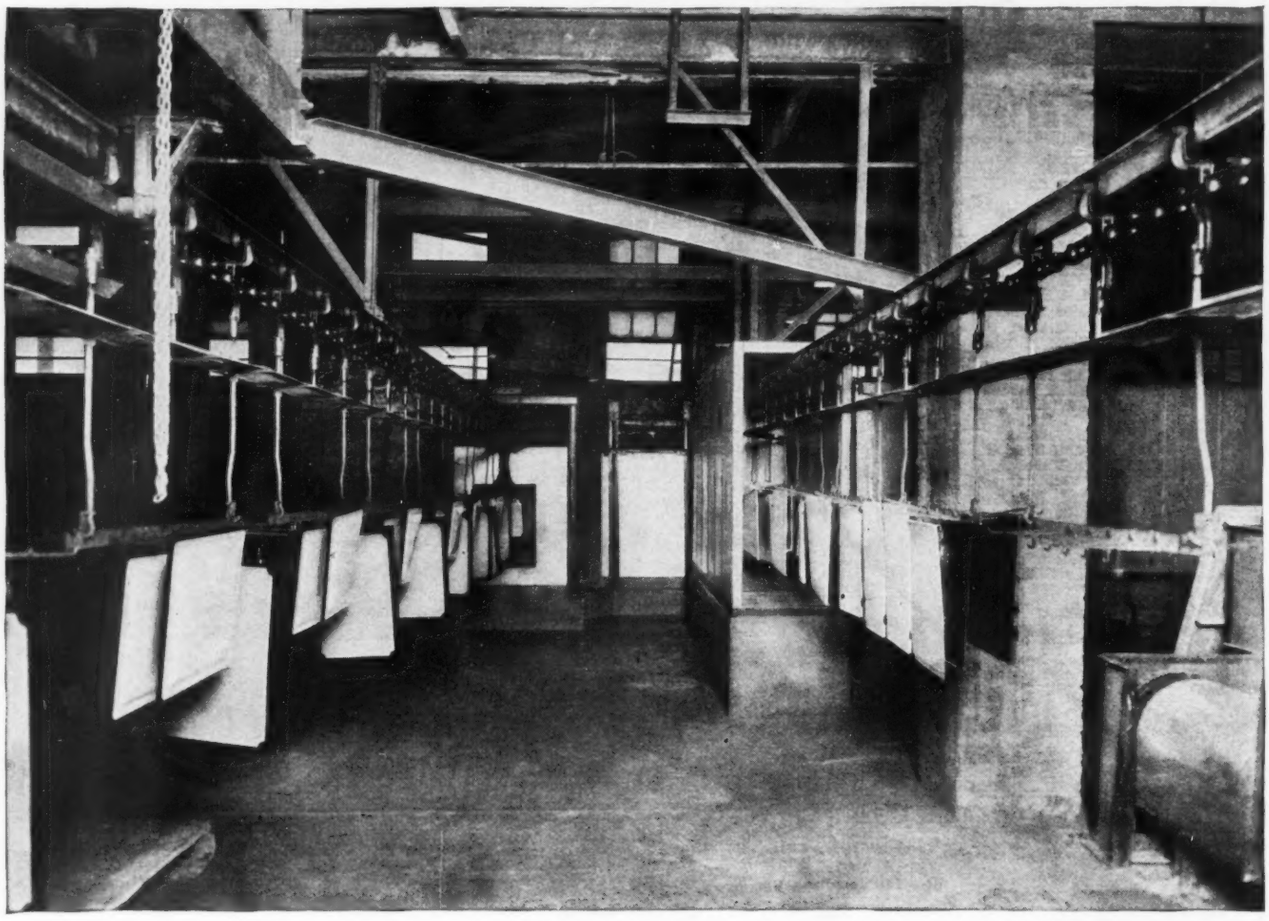
How the blowing time of BUSS SUPER-LAG FUSE compares with old type fuses



These charts show results obtained in tests made by Electrical Testing Laboratories of New York as reported by them August 25th, 1930 on the 200 ampere 250 volt size. 30, 60, 100, 400 and 600 ampere sizes as reported by them show similar results.

Blowing times shown on one overload are not comparable with those at other overloads because a different scale is used on each chart for convenience in comparing results.

GAS
FOR VITREOUS ENAMELING



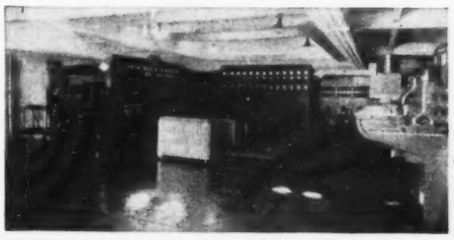
Practically every step in the vitreous enameling process is done better because of gas heat. Modern gas-fired furnaces speed up production and assure a better, cleaner job with fewer rejects for imperfections. The new book "Gas Heat in Industry" is full of data on the use of gas heat in every branch of industry.

AMERICAN *Gas* ASSOCIATION

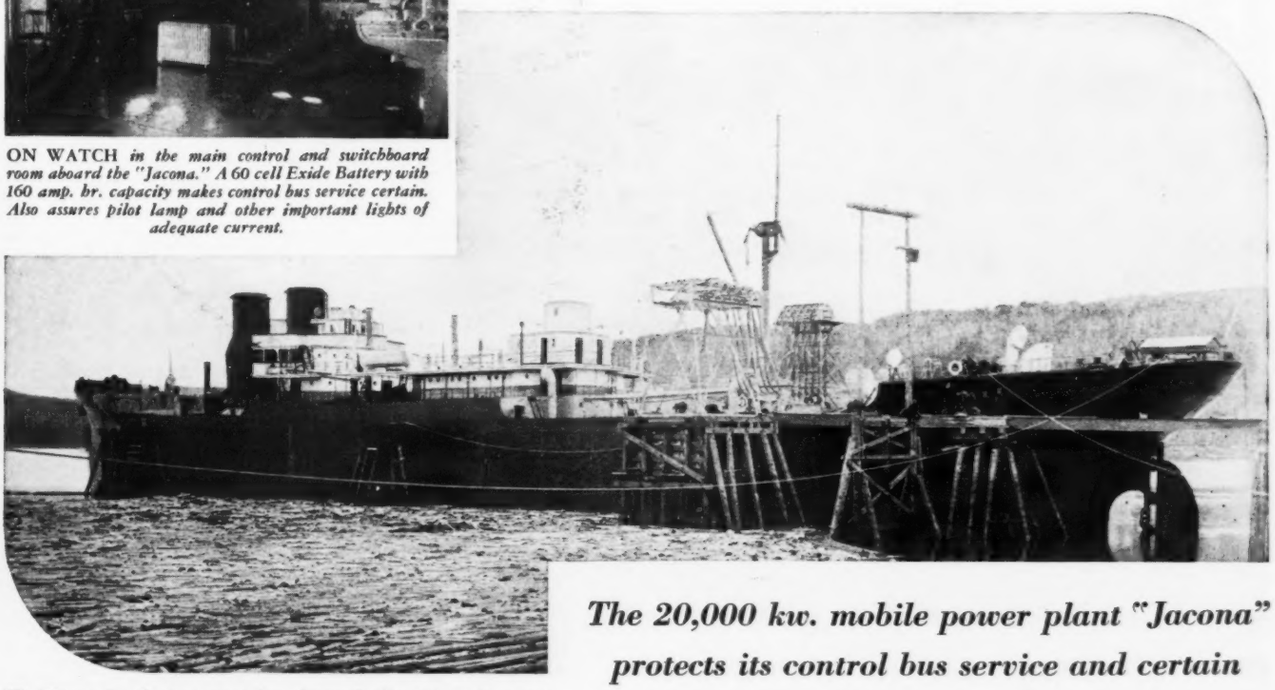
420 Lexington Avenue, New York

GAS FOR HEAT WHEREVER HEAT IS NEEDED

World's FIRST FLOATING Commercial Power Plant chooses Exide Battery



ON WATCH *in the main control and switchboard room aboard the "Jacona." A 60 cell Exide Battery with 160 amp. hr. capacity makes control bus service certain. Also assures pilot lamp and other important lights of adequate current.*



The "Jacona," a floating power plant, featured editorially in the recent Engineering and Marine Publications. Equipped with 60 cell Exide Battery. Owned by New England Public Service Company for use of its operating subsidiaries. Now furnishing power to a large paper mill at Bucksport, Maine, on the lines of the Central Maine Power Company.

The 20,000 kw. mobile power plant "Jacona" protects its control bus service and certain important lights with 60 cell Exide

AN EMERGENCY power plant itself, the "Jacona" cannot run the risk of *any* kind of current failure. It must be ready at a moment's notice to supply towns with adequate electric current, without fail. For these reasons the New England Public Service Company has selected an Exide Battery, for control bus service, important emergency lighting and pilot lamp illumination.

The absolute dependability of Exide Batteries is the reason why the majority of power and light companies throughout the United States have chosen them again and again, year after year.

The long life, unfailing performance and economical operating cost of Exides are well known to engineers. Remember this—when you are buying an Exide Battery you are also buying 43 years' experience in battery building, which assures you of *absolute battery dependability.*

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY CO.,
Philadelphia

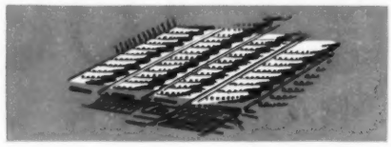
THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE

Exide Batteries of Canada, Limited, Toronto

USERS KNOW *the operating advantages of the many* DISTINCTIVE FEATURES *of* RILEY STOKERS —

Those who own and operate Riley Stokers know from their own experience the value of the many distinctive features of the Riley. As users operate their Riley Stokers they discover how well they are made and how well they meet the most extreme demands made upon them.

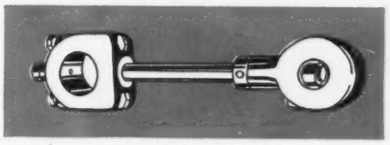
On the firing aisle they have found for themselves how important reciprocating retort sides are for attaining high capacity and economy. They know that the slicing, reciprocating action of the retort sides keeps the fuel bed in perfect



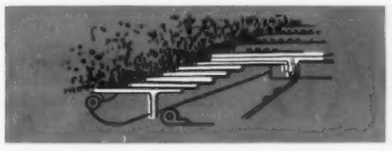
condition and assures excellent air distribution; that it is a most effective means of properly moving the fuel towards the bridge wall.

They realize that rocker plates with the peculiar motion are very effective for agitating, crushing and ejecting the ash. Because of this fact they are strong advocates of this feature.

And what explicit faith they have in the safety shearing pin. They know that it will protect the stoker should some foreign material obstruct the plunger. They like this particular design because it is so easy to replace the shearing pin and put that plunger back into service.

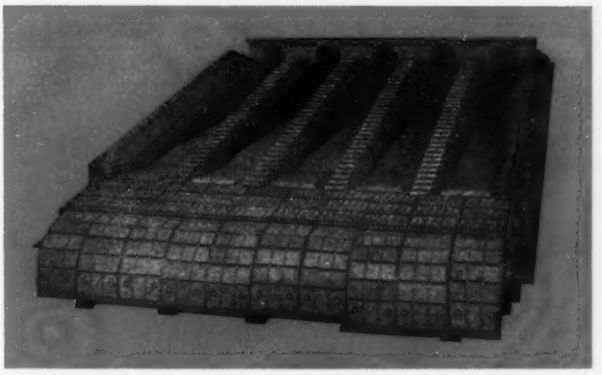


Users like the effectiveness of Riley overfeed grates because they completely burn the coked fuel before it goes to the ash pit. Overfeed grates as well as many other features are all Riley developments.



You will invariably find the Riley user a Riley booster. He has found that in actual operation, the Riley does its job most economically and satisfactorily. That the investment in Riley Stokers is a gratifying and dividend paying one.

RILEY *has developed a new* GRATE SURFACE *which makes The Riley Stoker* EVEN GREATER



The new Riley Type "J" grate surface is making the Riley Stoker even greater. The characteristics of this new grate surface assures better efficiency, higher capacity, and lower maintenance. This grate brings out to the utmost the excellent operating features of reciprocating retort sides.

At one of the country's largest public utilities, this new grate surface has made possible a steam production of 320,000 pounds per hour. This represents approximately 445% of rating on a 2290 H.P. boiler and 65 pounds of coal burned per square foot of grate surface. This production figure represented the limit of the induced draft fans.

When you consider a profitable investment in fuel burning equipment—and today's extreme demand for the greatest operating economy makes this imperative—a Riley engineer will enjoy being of service to you. You will find him the type of engineer you like to deal with.

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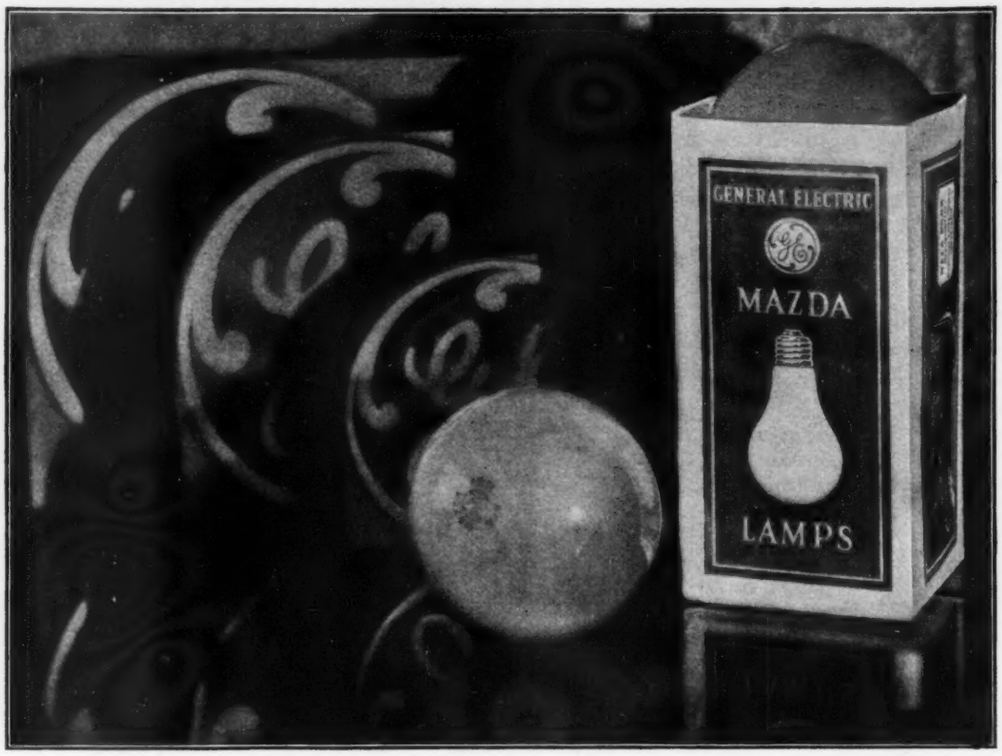

LEADING THE LOAD

•Lighting uses 75% of the residential load . . . make the most of it in 1931.

• The "appetite" of the residential meter will be of the utmost importance to every utility in 1931. Business is on the up-grade, but leadership in the anticipated kilowatt hour increase this year will lie with residential consumption, again. Alert utilities, therefore, are increasingly aggressive in this matter of home lighting, everywhere.

• For about 75% of the revenue from the residential field is secured from the lighting load. Something to tie to, to develop, to nurture, whatever general conditions may be.

• General Electric MAZDA lamps, steadily advancing in a period of depression, will fortify their position of leadership in 1931. That is because they are quality-insured, consigned to agents, ably advertised and skilfully merchandised. They stepped ahead in 1930. Feature them in every way to make your own lighting load step ahead with them in 1931. National Lamp Works of General Electric Company, Nela Park, Cleveland.

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Furnished as an integral part of the 1931 Window Display Service to our subscribers, it can be purchased for $1.50 delivered to any G. E. MAZDA lamp agents who are not subscribers to the service.

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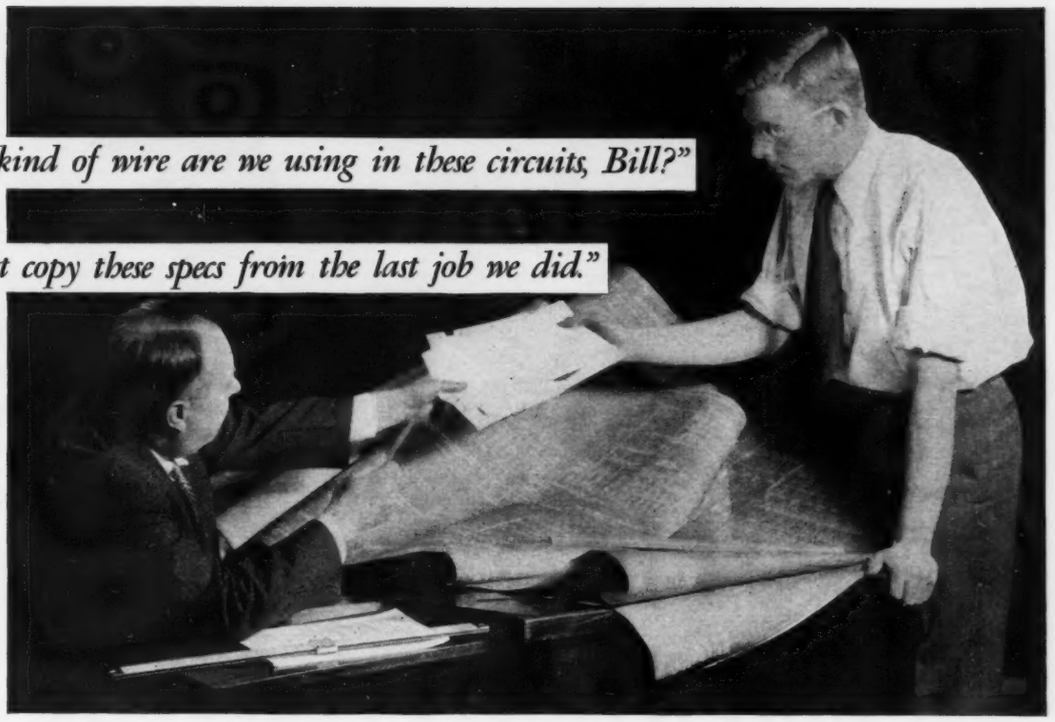

Do you select wire—by HABIT?

We venture to say there isn't a power station in the country with rheostats wired with rubber covered wire and cable.

Nowadays almost every rheostat installation is wired with some kind of heat resisting wire.

But it's no trick to find dozens of stations with boiler rooms full of rubber covered wire. Yet wire in boiler room circuits is often attacked by temperatures fully the equivalent of grid temperatures, many times higher, and usually for longer periods.

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And any plant electrician will confirm these experiments by telling of continuous failures and constant renewal of circuit wiring.

For a very little extra initial investment this constant expensive maintenance cost may be practically eliminated.

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C-H *Ltl* Control knows how to take care not only of itself but of its motor, of the equipment it "drives" . . . and it meets the operator's needs as well. So you save not only at first hand, but at second and third as well.

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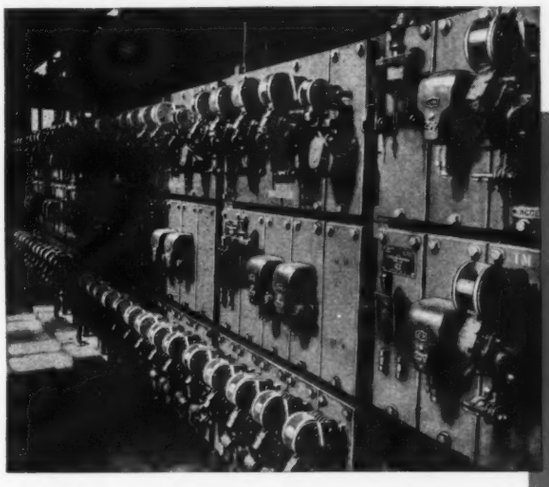

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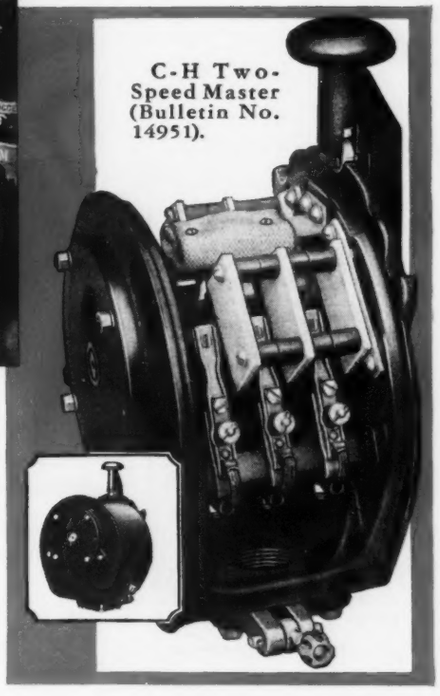

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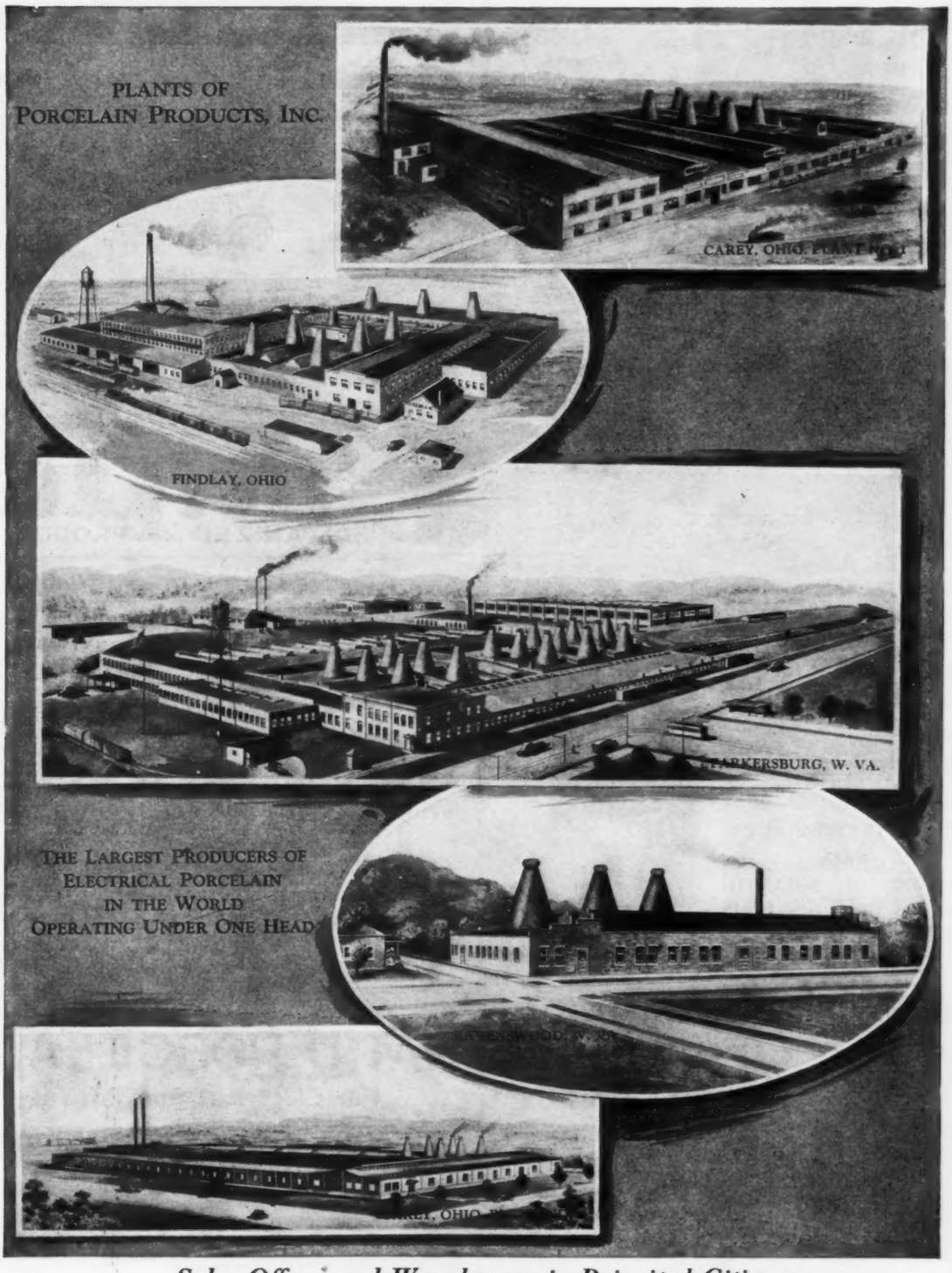

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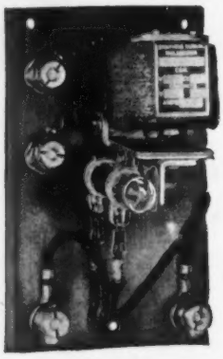

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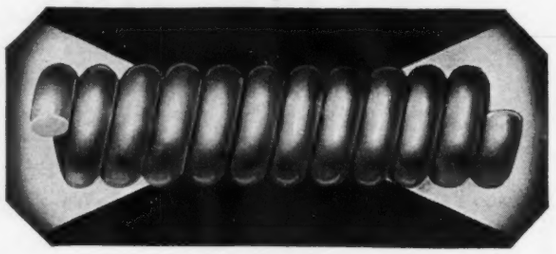

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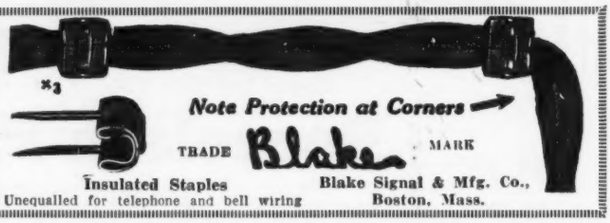

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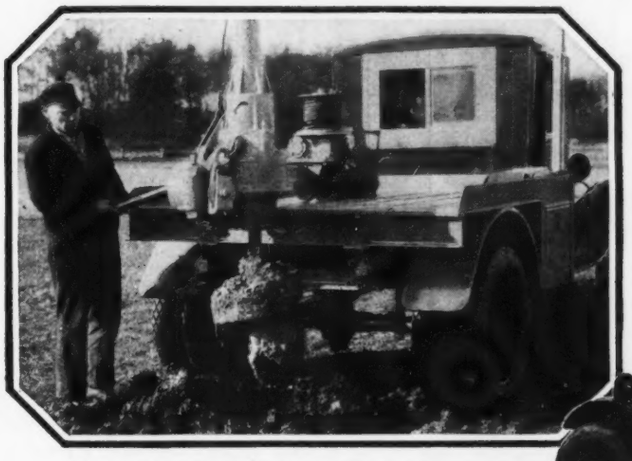

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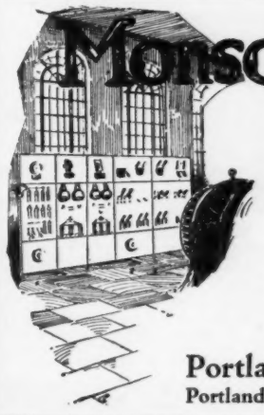

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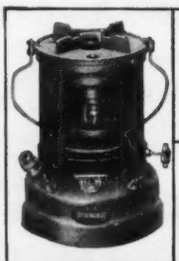

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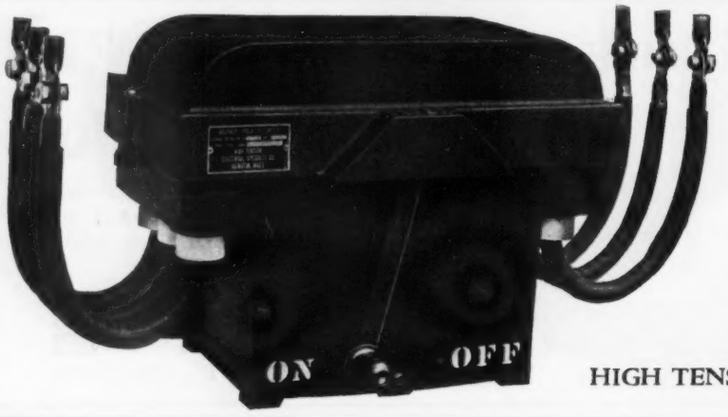

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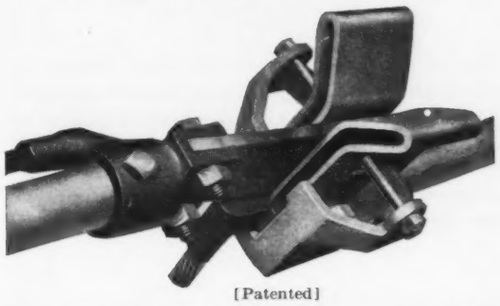

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Cap. 300-1,600 Amperes—7,500-15,000 Volts

A NEW Transfer Switch-

must be manually operated

A transfer switch with a positive locking device, in all three positions, and lock must be released before it can be moved from one position to another. Designed and developed to meet limited space conditions, this Triple Lock switch has met the approval of many of the country's leading central station and consulting engineers.

These switches provide for economical construction; existing transfer buses can be used without increasing the cell center spacings. Mounted on single-post insulators and 6 or 8 inch steel bases, they require minimum cell wiring assembly. Full details and quotations on request.

Switches for Special Purposes

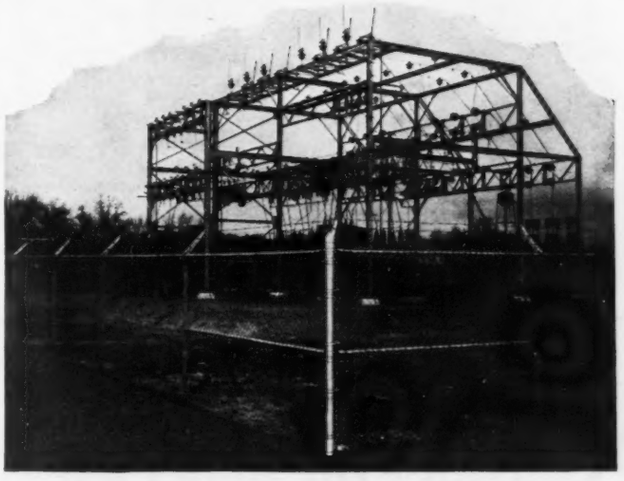
Thoner and Martens Switches are manufactured for all requirements; High Tension Indoor Disconnecting Switches, Heavy Duty Low Tension Switches and switches made to specifications to meet special conditions. We will gladly study and submit suggestions on any particular switch problem you may have.

THONER & MARTENS

Manufacturing Electricians

463 COMMERCIAL STREET - - - BOSTON, MASS.

Only when you can't be *Blamed* are you *Fully* PROTECTED



A fence whose function is to safeguard the public should be chosen with particular care. If it fails to provide adequate protection it may invite rather than discourage trespassers; or by inducing a false sense of security may become more hazardous than no fence at all.

A good fence protects against damage suits by injured trespassers, while a poor one may itself afford conclusive proof of negligence.

Continental Chain-Link Fence is structurally correct. It is erected under the supervision of experienced fence engineers. We shall be glad to advise with you without obligation. Write us today.

CONTINENTAL STEEL CORPORATION

KOKOMO, INDIANA

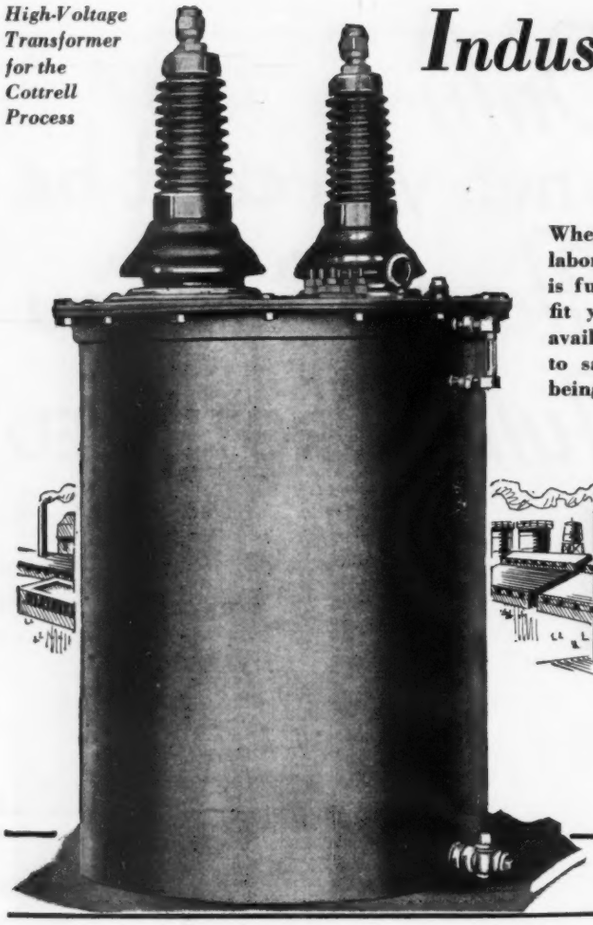
Distributors in all Principal Cities

Manufacturers of: Chain-Link, Farm, Poultry and Lawn Fence and Gates; Billets, Rods, Wire, Nails and Barbed Wire; Black, Galvanized and Roofing Sheets

CONTINENTAL

TRADE MARK (154)

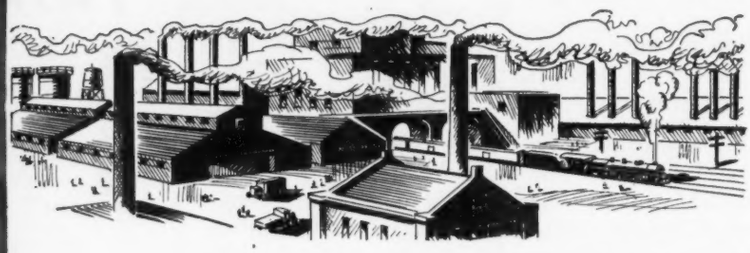
High-Voltage Transformer for the Cottrell Process



Industrial Transformers

for every requirement

Where transformers of any type are required for industrial, laboratory, or radio applications the American Transformer Co. is fully prepared to supply equipment of the highest quality to fit your exact specifications—and, if a standard unit is not available, our engineers will gladly design a special transformer to satisfy the requirements. We welcome the opportunity of being of service on all transformer problems.



AMERICAN TRANSFORMER COMPANY

Transformer builders for over 29 years.

170 EMMET ST. NEWARK, N. J.

AMERTRAN TRANSFORMERS

Consider the many uses of this new NEON GLOW LAMP

In home and garage the new 2-Watt Neon Glow Lamp finds many uses. As a night light in bathroom, bedroom, cellar, on stairway, in garage and to illuminate house numbers. Also in industry—as annunciator, signal and test lamps.

Can be kept lighted for a month on less than 5¢ worth of current! Fits standard socket—110 A. C. or D. C. No filament to break. Instead, a metallic disk which withstands shocks affords service for hundreds of hours. Write for details—and the sale and profit possibilities of this unique lamp. General Electric Vapor Lamp Co., 805 Adams St., Hoboken, N. J.

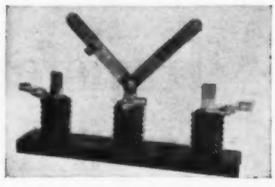
Join us in the General Electric Hour, broadcast every Saturday evening, on a nation-wide N. B. C. network.

GENERAL ELECTRIC VAPOR LAMP COMPANY

(Formerly Cooper Hewitt Electric Company)

472 © G. E. V. L. Co. 1930

Elpeco Switches



600 Amp. S.P.D.T Disconnecting Switch with "L" shaped blade used for group operation.

ELECTRIC POWER EQUIPMENT CORP.

412-20 N. 18th St., Philadelphia, Pa.

"Bates Poles Outlive the Bond Issues that Buy Them"

BATES POLES AND STRUCTURES

Bates Expanded Steel Corp.

General Offices and Plants

EAST CHICAGO, INDIANA, U. S. A.

MEMCO

Insulator Clamps	Fuse Mountings
Copper Fittings	Substation Combinations
Splicing Sleeves	Air Brake Switches
Disconnects	Bus Supports
Choke Coils	

Memco Engineering & Manufacturing Company, Inc.

381 Hamilton Street, Long Island City, N. Y.

Memco builds this equipment in all standard and special sizes—ask for bulletins of interest to you.

Tough and Strong Easy to use

MASTER SHOVELS and SPOONS

(with Alloy Steel Blades)

These two styles give users a type for every heavy duty need.

Handles of second growth Northern White Ash and straps electrically seam welded to blade, for your heavy duty digging needs. Good appearing and long lasting.

Write for complete details.

OSHKOSH
POLE LINE CONSTRUCTION TOOLS

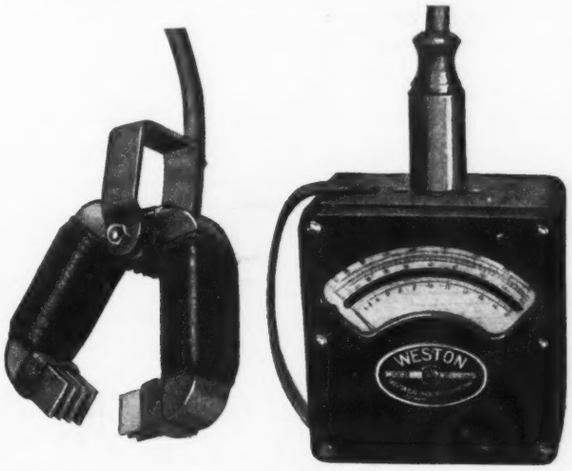
Leach Company
Dept. E
Oshkosh, Wisconsin

LEFT — Straight shovel, front view. RIGHT — Straight shovel, side view.

LEFT — Western pattern spoon. RIGHT — Eastern pattern spoon.

Reasonably Priced

LOAD TEST SET



Clamp-On Transformer, very light and compact. Includes WESTON Model 433 Ammeter, (Accuracy within 2%) 10 ft. Tirex Cable, and leather carrying case.

Ranges 12½/50/150/600 Amps, openings 1⅝ in. cable or 2⅝ in. bus bar, price.....$120.00

Ranges 25/100/300/1200 Amps, openings 2¼ in. cable or 3¼ in. bus bar, price..... 170.00

Write for Bulletin 1000.

ELECTRICAL ENGINEERING SALES COMPANY

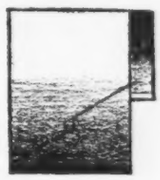
525 Market St. San Francisco, Calif.
426 S. Spring St., Los Angeles, Calif.

McINTIRE NOTCH-LOCK SATURATED PAPER-TAPE

Applying the tape to the joint. This shows how easy it is to lock the tape to the joint when starting to wrap it. Joints can be taped close to the shoulder.

AT LAST!

a high grade paper tape that's easy to unroll and lock to the joint . . . . . .



Upper View— Notch-Lock closed.

Lower view — Notch-Lock open.

No more difficulty in prying the end loose from the roll. No slipping of the loose end of the tape in wrapping it around the joint. McIntire Notch-Lock Paper Tape (patent applied for) eliminates all these troublesome and time-consuming inconveniences in the use of insulating paper tape.

It is the greatest improvement that has ever been made in paper tape. By means of this Notch-Lock feature it is easy to release the end of the roll and just as easy to quickly lock the tape to the joint. After one turn, the tape is secure. Requires less skill to apply. Makes a more efficient job. The illustration shows how simple it is.

McIntire Notch-Lock Saturated Paper Tape is made from the highest grade manila or wood pulp, impregnated with high dielectric strength oil, free from all foreign substances. Manufacturing by modern methods, under strict supervision, insures a product of the highest quality.

Oil Packed Varnished Cambric Tape furnished with the Notch-Lock.

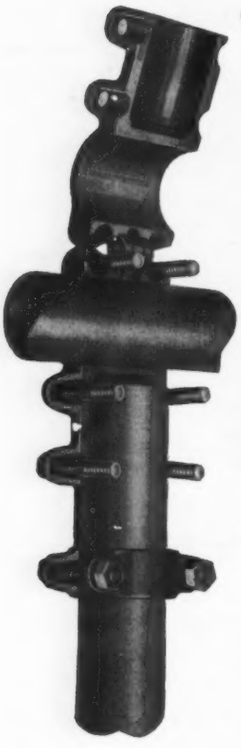
Every user of Paper tape should write for complete details and sample rolls.

McINTIRE CONNECTOR CO.
Jefferson and Chestnut Streets
Newark, N. J.

McINTIRE CONNECTORS and SLEEVES

BURKE CONNECTORS

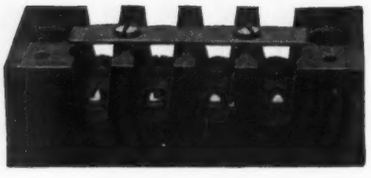
reduce installation costs



CLAMP AND HINGE TYPES

BURKE connectors permit the tap assembly on the ground, the connector and tap thus assembled can then be elevated to the run as a unit. The connector is held firmly in position on the tap by means of the auxiliary clamp, leaving the workman in the air with both hands free to open the hinge clamp, close it over run and insert bolts—a wrench is all you need. BURKE connectors are designed to meet mechanical requirements for strength and to provide ample current carrying capacity, the castings being all copper give them high conductivity.

See Bulletin C.T. 4



CONTROLEAD TERMINAL BLOCKS

BURKE Terminal Blocks are moulded of genuine "BAKELITE". They are built in three styles and five sizes. With this selection of sizes and by the use of the interchangeable accessory parts BURKE Controlead Terminal Blocks may be adapted to almost any control wiring circuit.

A new issue of Bulletin H2 illustrates and describes the complete line.

Write for your copy

Alternating and Direct Current Motors and Generators, Motor Generator Sets, Arc Welding Equipment.

BURKE
ELECTRIC COMPANY
main office and works: ERIE, PA.

Universal Motors Copper Connectors, Burkelect Insulators, Controlead Terminal Blocks.

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES

YES Glass

—UP TO 15,000 VOLTS

There are five good reasons—each one a valid reason for using Hemingray glass insulators on all of your medium voltage lines — Get our catalog — it explains them fully.

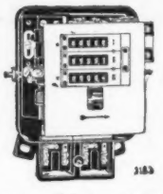
HEMINGRAY

HEMINGRAY GLASS COMPANY

General Offices and Factory Muncie, Indiana

3-Rate Meter

Information on 2-rate and 3-rate meters on request. (Type FBodm is the 2-rate meter.)



Type CBot single phase 3-rate watthour meter.

The Largest Line of Electricity Meters in the World

LANDIS & GYR, INC.

Herbert Nehls, V. P. and G. M.

104 Fifth Ave., New York

OLIVER POLE LINE MATERIAL

APPROVED AND ACCEPTED SINCE 1894

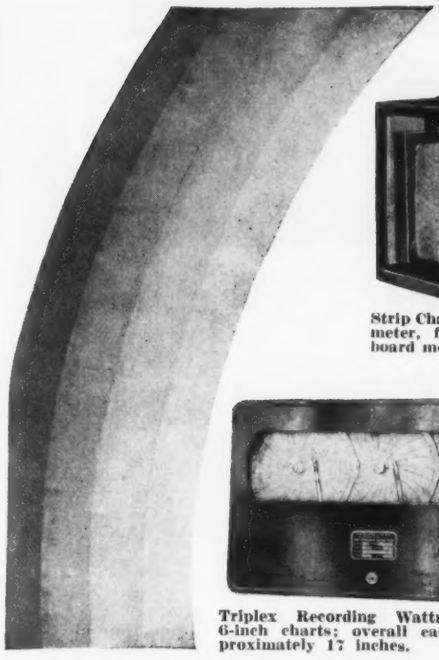
OLIVER IRON AND STEEL CORPORATION — PITTSBURGH

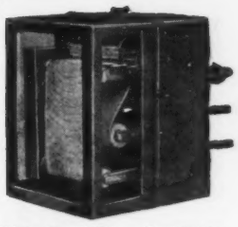
PINCO INSULATORS

The Correct Design

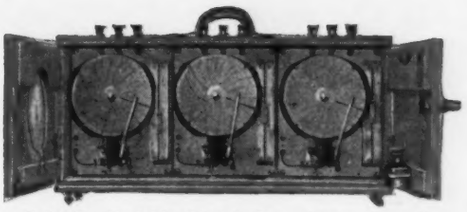
The Porcelain Insulator Corp.

LIMA, N.Y.





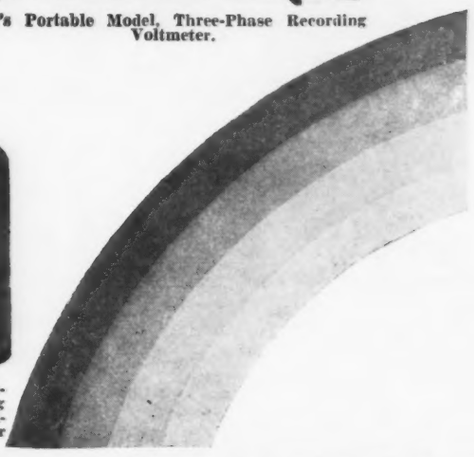
Strip Chart Recording Wattmeter, for wall or panelboard mounting.



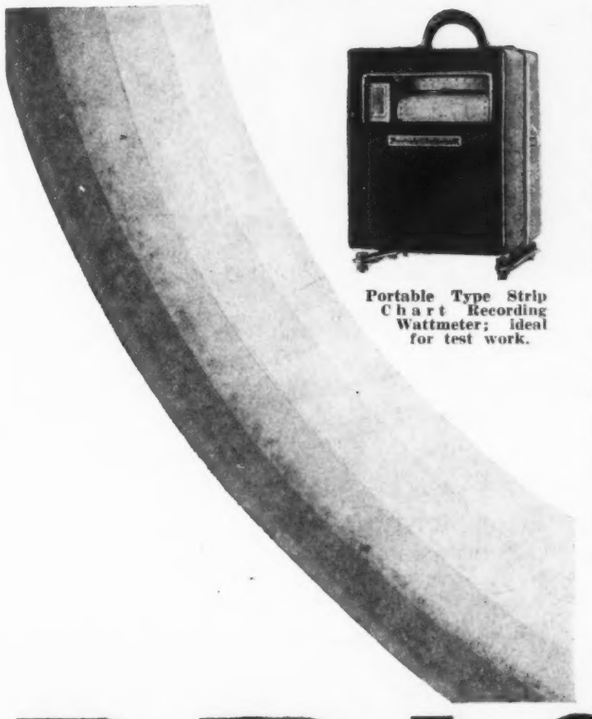
Bristol's Portable Model, Three-Phase Recording Voltmeter.

Triplex Recording Wattmeter. Uses 6-inch charts; overall case width approximately 17 inches.

Small sized Rectangular Form Recording Voltmeter; also available with Wattmeter movement.



FOR ACCURATE DETERMINATION OF COSTS



Portable Type Strip Chart Recording Wattmeter; ideal for test work.

THE production, purchase, distribution and sale of electrical energy involves considerable accounting. Costs must be known. Figures must be accurate.

That is one reason why so many public service companies utilize Bristol's Instruments. Their accuracy, serviceability and conveniences are features that have built up a wide acceptance by the electrical industry.

They are extensively employed to supply accurate data on amount of energy generated, voltage on distribution feeder lines, available power, power consumption of factory departments and other conditions. Full description of many instruments in Catalog No. 1502.

Our field service engineers are available to make recommendations.

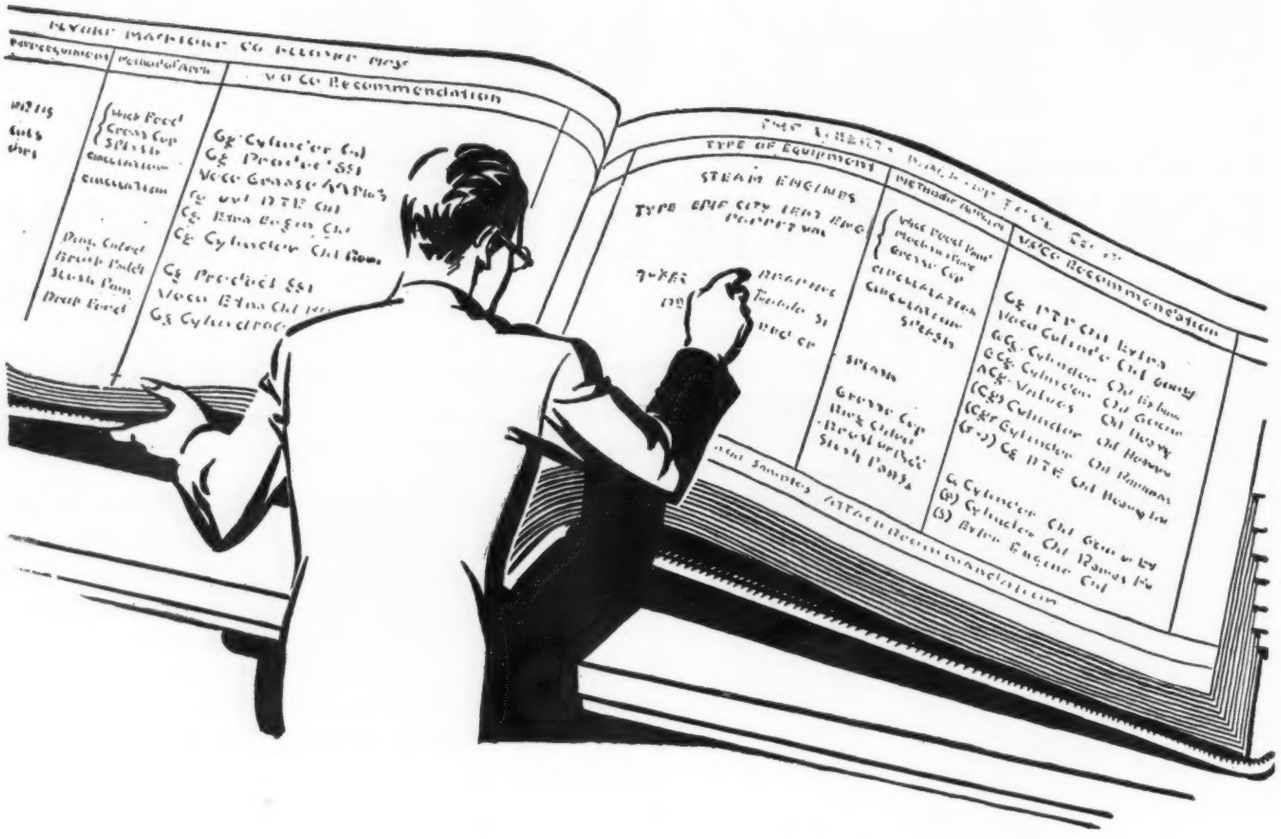
THE BRISTOL COMPANY
Waterbury, Connecticut

BRISTOL'S

SINCE 1889

Instruments *for* Indicating Recording Controlling

24,000



GARGOYLE OIL

Lubricating Oils

The world's quality oils for plant lubrication

EXPERTS

helped compile this book to help you

THE only book giving complete recommendations of lubricants for the machinery and engines of world-wide industry—is the Vacuum Oil Company's handbook, "Engine Builders' Book." Constant revision keeps it up-to-date. It contains the practical experience and technical knowledge of many thousand engineers, in the following groups:

The engineers of leading engine and machinery builders
Vacuum Oil Company engineers servicing world industry
Engineers in all kinds of industrial plants.

In a recent survey of American industry, 47% of important industrial men interviewed, reported unsolved lubrication problems. If *your* plant has one or more of these unsolved problems, or if you wish to avoid having them, the information in this book can help you. Every Vacuum representative carries a copy of this book. (It is not for general distribution.)

Twenty-four thousand heads are better than one. Give them an opportunity to serve you.

VACUUM OIL COMPANY

Headquarters: **61 Broadway, New York · Branches and distributing warehouses throughout the world**

NAHAVAT

In many towns of India one is awakened in the morning by sweet nahavat (flute playing).

This is because they fear that sudden sharp noises awakening a man will smother his reasoning soul and unhinge his mind.

They're absolutely right about this. Harsh noises at any time drive one to distraction.

If figures were obtainable you'd find that noisy carbon brushes are perhaps the direct cause of the growth of blasphemy in machine operation, in those isolated cases where the operator is not awake to the soul benefit from quiet Morganite brushes.

So, instead of alarming him, we continue to softly whisper:

Brush up on brushes
—Morganite.

Morganite Brush Co., Inc.

Main Office and Factory

3302-3320 Anable Ave., Long Island City, N. Y.

DISTRICT ENGINEERS AND AGENTS

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Cleveland, Electrical Engineering & Mfg. Co., 320 Union Building
Birmingham, Ala., A. J. Bowron, 1210 Watts Building
Revere, Mass., J. F. Drummey, 62 Pleasant Street
Los Angeles, Electrical Engineering Sales Co., 502 Delta Bldg.
San Francisco, Electrical Engineering Sales Co., 222 Underwood Building.
Toronto, Can., Railway & Power Engineering Corp., Ltd., 171 Eastern Ave.
Montreal, Can., Railway & Power Engineering Corp., Ltd., 898 St. Antoine Street
Winnipeg, Can., Railway & Power Engineering Corp., Ltd., P. O. 325.

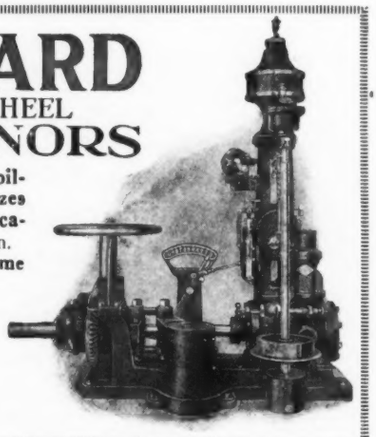
WE EXTEND the facilities of our organization to those desiring information or reports on companies with which we are identified.

Electric Bond and Share Company

Two Rector Street **New York**

LOMBARD
WATER WHEEL GOVERNORS

Powerful, quick-acting oil-pressure governors in sizes and types for any application or special condition. For many years, the name LOMBARD has stood for *reliable service* and *closest regulation obtainable.*



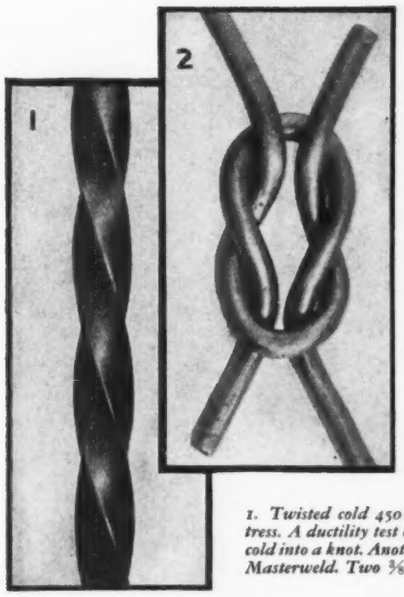
THE
LOMBARD
GOVERNOR CO.
ASHLAND, MASS

WHEN governor problems arise our comprehensive experience will be of value to you. "Write for Catalogue M."

WOODWARD GOVERNOR CO., Rockford, Ill.

WOODWARD
WATER WHEEL GOVERNORS

UNSURPASSED DUCTILITY AND TOUGHNESS



1. Twisted cold 450 degrees without showing signs of distress. A ductility test of Masterweld deposited metal. 2. Tied cold into a knot. Another test demonstrating the ductility of the Masterweld. Two ⅜" round specimens of deposited metal.

are combined in the Kellogg Masterweld

Ductility and toughness, strength and adaptability—these are the outstanding qualities of the Kellogg Masterweld. The Kellogg Masterweld always provides a perfect bond which has the full strength of the material welded.

Achieved by an automatic process which admits of no variables, the Masterweld can be applied to the fabrication of both fired and unfired pressure vessels. The Kellogg Masterweld has been given the highest rating by leading insurance companies. Vessels so fabricated, either of Kellogg Rolled Seamless Steel Cylinders or special welding quality plate, are dependable, efficient and economical.

Let us send you an illustrated brochure fully describing the Kellogg Masterweld as applied to pressure vessel fabrication.

THE M. W. KELLOGG COMPANY
225 BROADWAY NEW YORK, N.Y.
Birmingham, 827 Brown-Marx Bldg.; Boston, 12 Pearl Street; Chicago, 1 La Salle Street; Pittsburgh, Oliver Bldg.; Los Angeles, 742 Western Pacific Bldg.; Tulsa, Philtower Bldg.

DUCTILE

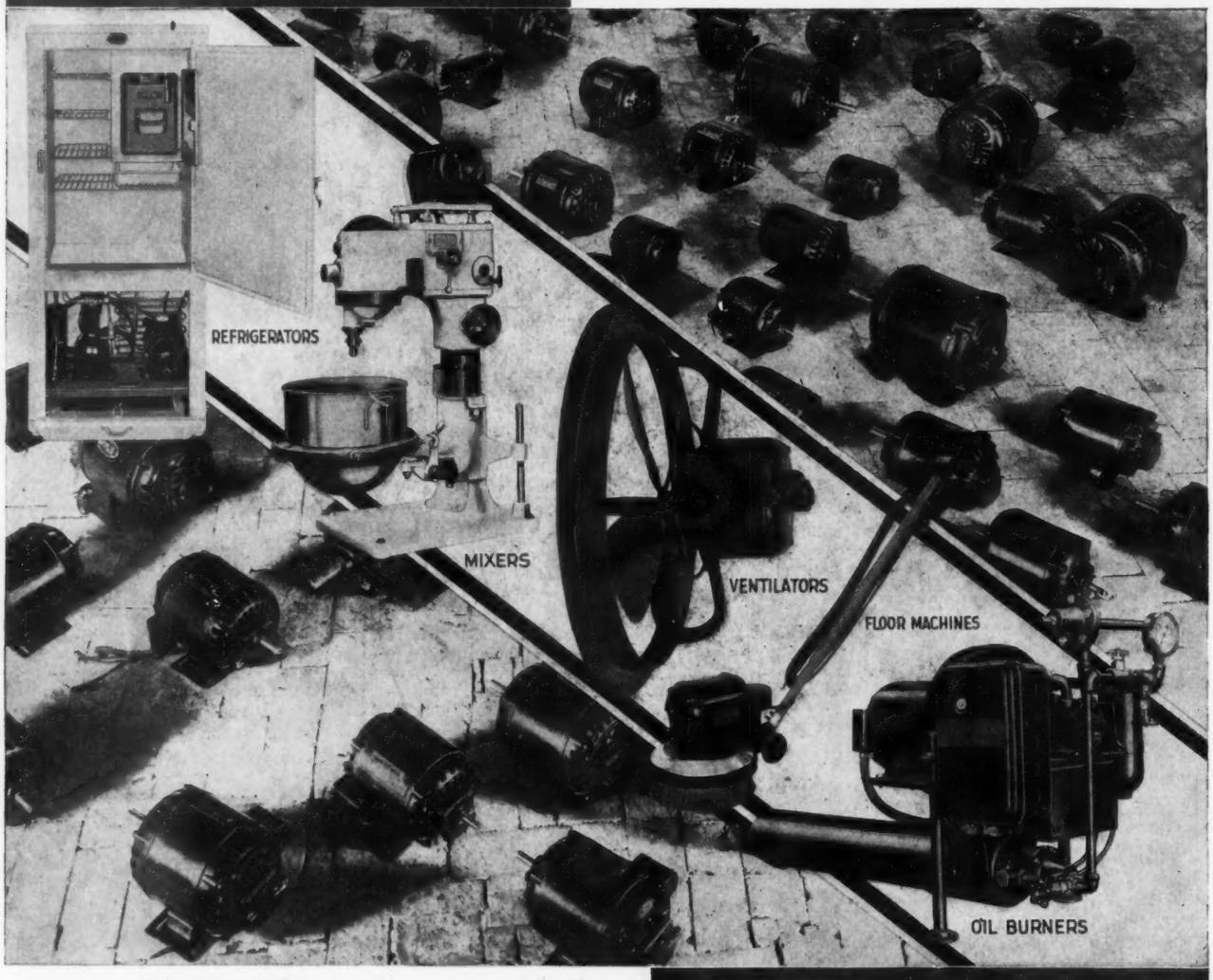
KELLOGG *Masterweld*

TOUGH

Kellogg Products include Welded Boiler Drums, Receivers, Separators, Headers and Complete Power Plant Piping

Dependable motors for the home

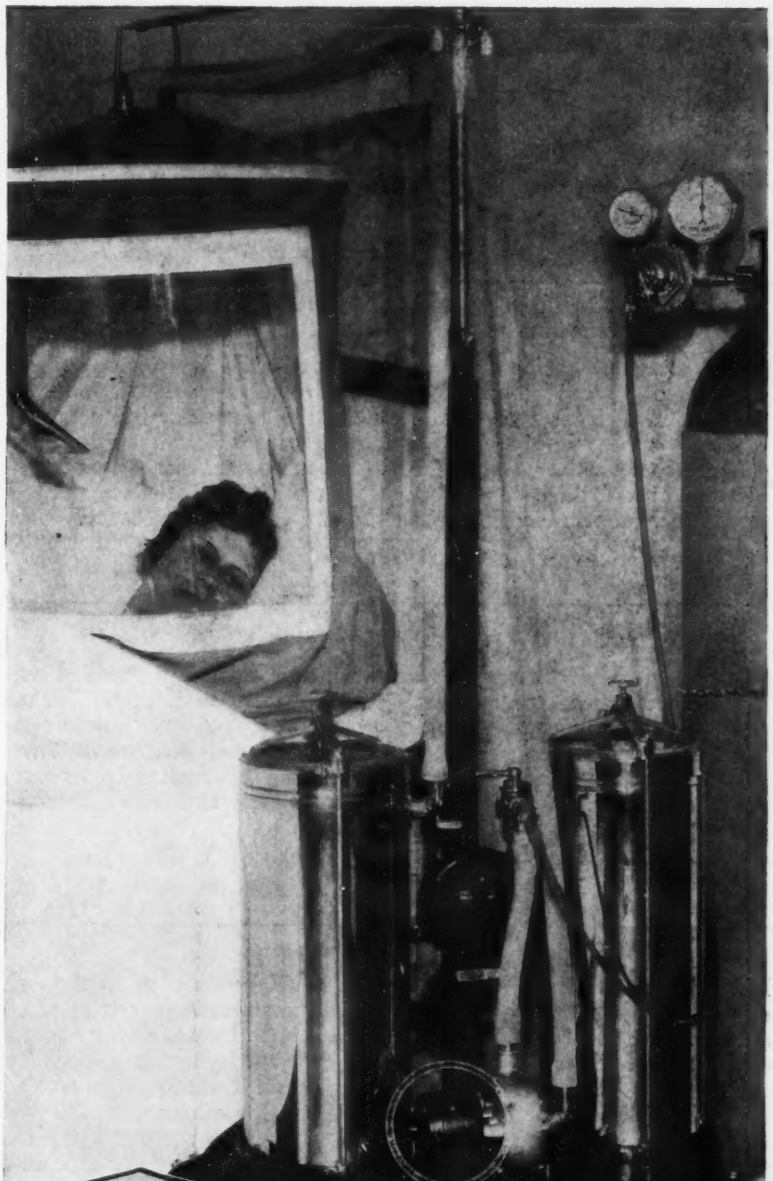
The modern home is just as dependent upon electric motors as the modern factory. The modern home depends upon motors for refrigeration, ventilation—for heating, cleaning, washing, ironing, sewing—yes, even for musical entertainment, physical exercise, and the time. No wonder that motors intended for domestic service have to be absolutely dependable! » » Refrigerators, mixers, ventilators, floor polishers, oil burners, and other domestic appliances—all require motors that stand up under the abuses to be expected at the hands of users who know nothing about machinery. » » Dependability is the yardstick by which Wagner motors are measured. Each motor is built to give trouble-free uninterrupted service—wherein lies the reason for the ever increasing number of power companies demanding Wagner motors, and the choice of Wagner motors as standard by so many manufacturers of electrically powered appliances. » » »



Wagner
Electric Corporation
6400 Plymouth Avenue, Saint Louis, U. S. A.
MOTORS TRANSFORMERS FANS
LOCKHEED HYDRAULIC BRAKES

S231-5XB

Where Failure May Mean Disaster DUMORE MOTORS Perform Unfailingly!



THE Collins Oxygen Tent is an unusually interesting example of the widespread use to which Dumore Motor features are adapted.

"Unfailing service" is an absolute requirement in the Collins Oxygen Tent, which is used in the treatment of pneumonia, as illustrated at the left. It is generally used 24 hours a day for as many days as necessary, which may be as long as 21 days or more. Under these trying conditions, only a thoroughly dependable motor that will run day and night, without attention, can be used.

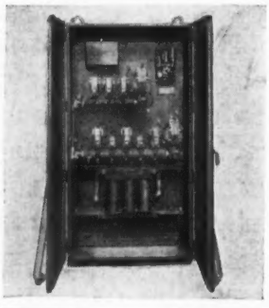
Dumore Motors do this admirably. In more than 600 Collins Oxygen Tents now in use, *not a single Dumore has failed at any time* . . . Dumore Motors can be profitably adapted to the product you manufacture.

THE DUMORE COMPANY
33 Sixteenth Street Racine, Wisconsin

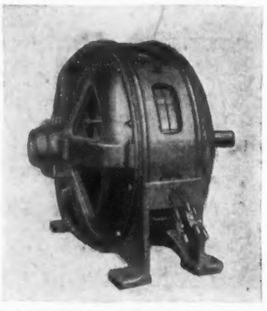
DUMORE
FRACTIONAL HORSEPOWER
MOTORS

Neglect mending 'twill soon be a small Fault, and a Great One

[The Sayings of Poor Richard]



A step in modernization was brought about by the frequent unexplained stopping of a large synchronous motor driving a vital unit in a plant process. Investigation revealed that the too hasty starting of a large induction motor in a remote department caused a voltage dip severe enough to throw the synchronous motor out of step. The substitution of a magnetic controller for the manual controller on the induction motor resulted in uniform starting with minimum voltage disturbance.

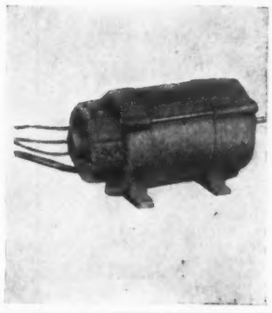


Trenches in the snow over buried cables in a mill yard revealed overheating of the distribution system because of low power-factor. The mill power-factor was unity by virtue of a battery of synchronous motors near the substation. Inside circuits with lagging power-factor of 0.72 were improved by substituting, at strategic points, 0.8 leading-power-factor synchronous motors for induction motors. The superseded induction motors were later used, fully loaded and in conjunction with synchronous motors, in an addition to the mill.

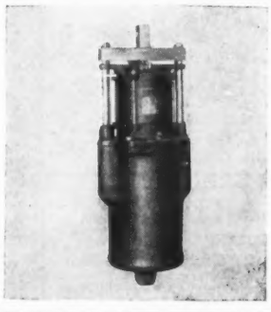
Did you know that a photoelectric tube could be made to do the work of a stop, dog, latch, or cam? Here's an example: A length of pipe is chucked near the middle, no care being taken to locate it. Two motor-driven tool carriages rush in towards the ends and, when one-eighth inch from contact, they slow down to feeding speed. The tools then face and bevel the pipe ends for field welding. The tool carriages act as they do because the pipe intercepts beams of light carried by the carriages. This modern type of cam, dog, etc., involves no maintenance, for a beam of light has no wearing parts.

Modern motors designed for quick starts, stops, and reversals, absorb only a small amount of power for their own acceleration, hence leave more for effective work. They are just coming into use for shears, whereon they start, accelerate, execute the work, and stop for each operation. This does away with flywheel and jaw clutch, simplifies the machines, and reduces maintenance. One such machine cuts three 8-in. by 8-in. blooms at a time—fourteen complete cycles per minute. A shear cutting 40-inch-wide material goes through the complete cycle in less than one second. The trend is to let the motor do it.

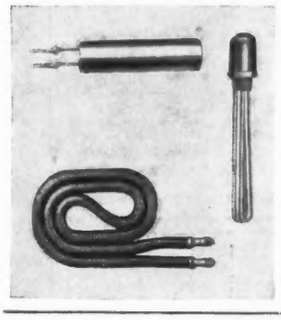
Any manufacturer who still feels that metallic arc welding might not be dependable should take note of the fact that big gun-mounts are being thus fabricated at the Watertown arsenal by the U. S. Government. Modern materials, equipment, and technique have made the arc-welded joint capable of standing any amount of shock duty that the parent metal will stand. Small wonder that manufacturers of machine tools and plant equipment are rapidly changing over their products to arc-welded steel construction and are obtaining a simpler, stronger, lighter, more rigid product with an enhanced appearance that stimulates sales.



The old "layshaft" and other rigid mechanical means for holding related equipment in synchronism while working on a common product are giving away to electric synchronization. Feeders are synchronized with the machines they feed, by Selsyn control, and the units may be any distance apart. To synchronize devices at full speed has never been difficult, but now it is possible to hold many units in absolute synchronism all the way down to dead stop and up again to full speed. This is done on a multiple-unit printing press and so accurately that, if desired, an "i" printed on one unit might be dotted on the next.



Speaking of modernization, have you studied all the possible applications to your equipment of the new G-E thrustor? This electric device exerts a smooth, powerful, constant-pressure thrust with cushioned return. On the up stroke, oil is pumped through a piston by a motor-driven impeller. On the down stroke, the piston sinks through a cushion of oil. Some suggested applications are: (1) the smooth, certain application of brakes to hoists. (2) The engaging of clutches on punch presses or shears. (3) The replacement of muscular effort on foot- and hand-operated machines, thus making the machines "all-electric."



In the past, when a machinery builder wished to build heat into his machines, or a plant engineer wished to apply a limited amount of heat to a process, it was necessary to install a steam boiler, or to run complicated fuel pipe lines to the zones to be heated. To-day, a G-E heating specialist is called in and, after studying the requirements, recommends G-E "Spots of Heat"—handy, self-contained, electric heating units which can be immersed, screwed in, built in, or simply attached to the machinery or equipment to provide clean, safe, odorless, precisely controlled electric heat.

Modernization Reduces Costs—Increases Profit

There are any number of ways in which the G-E sales engineer can help you to modernize. Ask him about them when he calls; or write the nearest G-E office.

200-463

GENERAL ELECTRIC

Directory of Engineers

ALLIED ENGINEERS, Inc.
Engineers and Constructors
20 PINE ST., NEW YORK
Birmingham, Ala. Jackson, Mich.

AMBURSEN CONSTRUCTION CO.
Incorporated
AMBURSEN DAMS
Hydro-electric Developments
Water Supply and Irrigation Dams
DAMS ON DIFFICULT FOUNDATIONS
Grand Central Terminal, New York
Kansas City, Mo. Atlanta, Ga.

WILLIAM A. BAEHR ORGANIZATION, Inc.
ENGINEERS—ACCOUNTANTS—MANAGERS
231 South La Salle St.
CHICAGO

BARKER & WHEELER
Utility and Industrial Valuations. Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal. Factory Production and Cost Control Systems.
11 Park Place, New York City
36 State St., Albany, N. Y.

BATTEY & KIPP
Incorporated
ENGINEERS
Power Plants, Electrification Developments, Industrial Plants Railway Shops and Terminals, Design, Construction, Investigations, Appraisals.
231 S. LA SALLE ST., CHICAGO

BLACK & VEATCH
Consulting Engineers
Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.
307 S. Hill St., Los Angeles, Calif.
230 Park Avenue, New York City
Mutual Building, Kansas City, Mo.

BYLLESBY
ENGINEERING AND MANAGEMENT CORPORATION
231 S. LaSalle Street, Chicago
New York Pittsburgh San Francisco

EDWARD J. CHENEY
ENGINEER
PUBLIC UTILITY PROBLEMS
61 Broadway New York

HUGH L. COOPER & CO.
General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.
101 Park Ave. New York

M. J. DALEY & CO. INC.
SPECIALIZING IN THE CONSTRUCTION OF:
Railroad Electrification.
Transmission Systems.
Power House and Sub-Stations.
Electrical Installations.
1654 Main Street Springfield, Mass.

VICTOR A. DORSEY & CO.
Engineers
Public Utilities and Industrials
Examinations—Reports—Valuations—Management
Chicago, Illinois

ELECTRICAL TESTING LABORATORIES
Electrical and Mechanical Laboratories
Tests of Electrical Machinery, Apparatus and supplies, Materials of Construction, Coal, Paper, etc. Inspection of Material and Apparatus at Manufactories.
80th St. and East End Ave., New York

FARGO ENGINEERING CO.
CONSULTING ENGINEERS
Jackson, Michigan
Hydro-Electric and Steam Power Plants
Difficult Dam Foundations

FRANK F. FOWLE & CO.
Electrical and Mechanical
ENGINEERS
221 No. La Salle St. Chicago, Ill.

HARZA ENGINEERING CO.
Consulting Engineers
Dams, Hydraulic, Hydro-Electric, Flood Control and Sanitary Projects
20 N. Wacker Drive
Chicago

HASTINGS & SANDERS CONSTRUCTION CO.
General Contractors, WARE, MASS.
Transmission Lines Distribution Systems
Power Houses and Substations
Electrification of Railroads
"Everything on time, and right."

HOOSIER ENGINEERING COMPANY
Erecting Engineers
Transmission Lines, Substations
100 W. Monroe St., Chicago, Ill.
225 Broadway, New York
Smith Tower, Seattle, Wash.

GEO. L. HOXIE
Consulting Engineer
ENGINEERING ECONOMICS
601 W. 5th St. Los Angeles, Cal.

IVES & DAVIDSON
ENGINEERS
Construction—Management—Valuation
PUBLIC UTILITY PROPERTIES
Design—TRANSMISSION LINES—Build
15 Park Row, New York

KELSO-WAGNER COMPANY
Construction Engineers
Transmission Lines—Substations
Underground
See our page advertisement 4th issue each month.
134 West Second St., Dayton, Ohio
Telephone Main 1434

CHARLES F. LACOMBE
WILLIAM S. LEFFLER
Engineers
Public Utility, Administrative
Economic and Municipal Problems.
Cost Analysis.
Inducement Rate Development.
Rate Cases—Appraisals.
11 West 42nd St., New York

WILLIAM S. LEE
Mem. Am. Soc. C. E.
Mem. Am. Soc. M. E.
Mem. Eng. Inst. Can.
Fellow Am. Inst. E. E.
CONSULTING ENGINEER
535 Fifth Avenue, New York City
Charlotte, North Carolina

LUCAS & LUICK
ENGINEERS
Power Plants Transmission Lines
Industrial Plants
Examinations Reports Valuations
Rate Cases
Public Utility Management
231 So. LaSalle St., Chicago

CHAS. T. MAIN, Inc.
ENGINEERS
Public Utilities and Industrials
Reports—Electrical Designs—Valuations
Supervision of Construction
201 Devonshire Street, Boston, Mass.

DANIEL W. MEAD
F. W. SCHEIDENHELM
Consulting Engineers
Hydro-electric Developments, Water Supply, Irrigation, Drainage, Flood Control.
New York City, 50 Church St.

ARTHUR L. MULLEGREN
CONSULTING ENGINEER
Steam and Electric Power Plants
Public Utilities
KANSAS CITY, MO.

FARLEY OSGOOD
Consultant
Design, Construction, Operation
Inter-Connection
of
PUBLIC UTILITIES
National Bank of Commerce Building
21 Nassau St., New York, N. Y.
Telephone: Rector 7878. Cable Address: Fargood

Directory of Engineers

W. EDGAR REED
Consulting Engineer
Designer of Electrical Machinery
Estimates, Reports, Plans, Specifications and Supervision of Lighting, Railway Industrial and Power Installations.
585 Union Arcade Bldg., Pittsburgh, Pa.

SCOFIELD ENGINEERING CO.
Consulting Engineers
Public Utility and Industrial Plants
Design—Construction—Operation—Investigations—Valuations
PHILADELPHIA

WAGGONER CONSTRUCTION CO.
Public Utility Construction
Transmission and Distribution
Underground or Overhead—Gas and Electric Street Lighting Installations
2 Cannon Street, Poughkeepsie, N. Y.

SANDERSON & PORTER
ENGINEERS
for the
FINANCING–REORGANIZATION–DESIGN–CONSTRUCTION
of
INDUSTRIALS and PUBLIC UTILITIES
Chicago New York San Francisco

W. J. SQUIRE
Consulting Engineer
Railways—Power Plants
Industrial Power and Illumination
Transmission Lines, Appraisals and Reports
618 Dwight Bldg., Kansas City, Mo.

The J. G. White Engineering Corporation
Engineers—Constructors
Oil Refineries and Pipe Lines, Steam and Water Power Plants, Transmission Systems, Hotels, Apartments, Office and Industrial Buildings, Railroads.
43 Exchange Place New York

SARGENT & LUNDY
Incorporated
ENGINEERS
20 North Wacker Drive
Chicago, Illinois

HOWARD M. TURNER
Consulting Engineer
Investigations, Valuations, Plans, Supervision of Construction — Water Power, Water Supply, Public Utilities.
12 PEARL ST., BOSTON

J. G. WRAY & CO.
ENGINEERS—CONSTRUCTORS
UTILITIES and INDUSTRIALS
Bankers Bldg., 105 W. Adams St.
Chicago

K+E=GA

Knowledge plus experience equals good advice. Their wide knowledge and years of experience prepare the engineers listed in this directory to give advice worth following. They are equipped to help you solve your most difficult electric generation and transmission problems.

Consult this Directory for dependable engineering services.

SEARCHLIGHT SECTION

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service established twenty-one years ago, to conduct confidential preliminaries, and assist the qualified man in location the particular position he desires. Not a registration bureau. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 262 Main Street, Buffalo, N. Y.

EXECUTIVES, electrical, public utility, manufacturing, sales, office, chemical, engineering, etc. Write for particulars regarding our confidential and individual service. H. H. Harrison, Supervisor, The National Business Bourse (Est. 1915), Great Northern Bldg., Chicago, Ill.

POSITIONS WANTED

ACCOUNTANT, 7 years in charge re: prior purchase investigations utility properties, installation of accounting systems, audits of holding companies, etc. 8 years public accounting re investigations, audits and systematizing. Matthew F. O'Connell, 559 West 158th Street, New York.

POSITIONS WANTED

ELECTRIC meterman, age 28, married, ten years' experience installing, testing, repairing electric meters and equipment. PW-839, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

ELECTRICAL inspector, with seven years' experience as purchaser's representative at factories, for witness tests and inspection of all classes of electrical equipment, desires connection. PW-837, Electrical World, 520 No. Michigan Ave., Chciago, Ill.

ELECTRICAL superintendent: eighteen years' experience covering all branches of electrical power. Desires responsible position with industrial or power company. Replies confidential. Address P. O. Box No. 1140, Detroit, Michigan.

ELECTRICIAN—Fourteen years utility and industrial construction and maintainance. Age 32. Married. Ditto, 207½ Ninth Ave., Charles City, Ia.

POSITIONS WANTED

ELECTRICAL Engineer with broad electrical and mechanical experience covering fifteen years in mining, steel, utility and technical publishing fields open for position in research, development, or engineering with heavy basic industry, manufacturing industry, or engineering firm. Analytical type with good references, available at once. PW-833, Electrical World, Tenth Ave. at 36th St., New York.

ELECTRICIAN, 16 years' experience, motor winding, construction, industrial, maintenance. Best of reference: 12 years with last company. Reason of change, plant moved to foreign county. J. W. Newton, 1808 N. Pegam St., Charlotte, N. C.

ENGINEER, 32, American, 12 years' experience, public utilityinvestigation, design and construction power plants, valuations, economics, interconnections, reports, building construction, hydraulics, structural design. Available immediately. PW-825, Electrical World, Tenth Ave. at 36th St., New York.

(Continued from the following page)

GOOD JOBS OPEN
Central stations must have meter experts. Hundreds of competent men wanted for positions paying $3,000 and over. We can train YOU at home in your spare time.
BE A METER ENGINEER
A postcard brings full details. No obligation.
FT. WAYNE CORRESPONDENCE SCHOOL
Dept. C., Ft. Wayne, Ind.

Electrical Engineering Training for men of ambition and limited time. Condensed course in Theoretical and Practical Electrical including Mathematics and Mechanical Drawing. Students construct motors, install wiring, test electrical machinery. Course complete in ONE COLLEGE YEAR. *Catalog.*
BLISS ELECTRICAL SCHOOL
253 Takoma Ave., Washington, D. C.

SEARCHLIGHT SECTION

EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or SPECIAL

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 5 cents a word, minimum $1.00 an insertion, payable in advance.

Positions Vacant and all other classifications, 10 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 to 3 inches.....$6.00 an inch
4 to 7 inches..... 5.75 an inch
8 to 14 inches..... 5.50 an inch
Other spaces and contract rates on request.
An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

E.W.

COPY FOR NEW ADVERTISEMENTS RECEIVED UNTIL 10 A.M. MONDAY FOR SATURDAY'S ISSUE

POSITIONS WANTED

(Continued from the preceding page)

GRADUATE EE., 26 years; graduate student course and test experience at Westinghouse E&M Co., wants work with responsible public utility or power company. Interested in construction or distribution work. Location, west or midwest. Available now. PW-827, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

GRADUATE EE., 39 years old. Desires position as relay and meter tester or engineer. Capable of supervising test department. Some experience on distribution systems, layouts, operation, etc. Middle or western states preferred. PW-838, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

MAINTENANCE engineer. Graduate E.E. Four years experience in operation, maintenance and repair of all kinds of D.C. and A.C. equipment. References. PW-840, Electrical World, Tenth Ave. at 36th St., New York.

POWER, Electrical, Plant Engineer seeks position with large Industrial Plant or Utility. Broad experience in Power Production adn Plant Maintenance. Excellent references furnished. PW-836, Electrical World, Tenth Ave. at 36th St., New York.

SALESMAN AVAILABLE

SALES manager or salesman, 20 years' successful experience, electrical, mechanical, treated timber and handling men. SA-805, Electrical World, Tenth Ave. at 36th St., New York.

U. S. Government

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., March 19, 1931.—Sealed bids in duplicate subject to the conditions contained herein, will be publicly opened in this office at 3 p.m., April 16, 1931, for furnishing the materials and performing the work required for instaling one passenger elevator in the U. S. post office and court house at Rutland, Vt. All prospective bidders are hereby notified that, prior to the award of the contract, the right is reserved by the supervising architect to require any or all bidders to submit a "Statement of Facts as to Qualifications to furnish elevators in strict accordance with the Specifications" in detail of the business and technical organization of the bidder available for the contemplated work, including financial resources, building experience, material proposed to be used, etc. The United States expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources, or building experience compared with the project bid upon, or materials proposed to be used, justify such rejection. The successful bidder will be required to furnish a performance bond of 50 per cent of the contract price. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931, (Public No. 798). Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (212)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., March 13, 1931.—Sealed bids in duplicate subject to the conditions contained herein, will be publicly opened in this office at 3 p.m., April 10, 1931, for furnishing the materials and performing the work required for installing a complete elevator plant in the U. S. post office, etc., at Lubbock, Texas. All prospective bidders are hereby notified that, unless the following information has been furnished within the last year on some other project for the Treasury Department, any bid submitted in response to this advertisement must be accompanied by a statement of facts in detail of the business and technical organization of the bidder available for the contemplated work, including financial resources and building experience, etc. The United States expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources, or building experience compared with the project bid upon, justify such rejection. The successful bidder will be required to furnish a performance bond of 50% of the contract price. Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (213)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., March 17, 1931.—Sealed bids in duplicate subject to the conditions contained herein, will be publicly opened in this office at 3 p.m., April 14, 1931, for furnishing the materials and performing the work required for installing one passenger elevator in the U. S. post office and court house, extension and remodeling, at Sioux Falls, S. Dak. All prospective bidders are hereby notified that, prior to the award of the contract, the right is reserved by the supervising architect to require any or all bidders to submit a statement of facts in detail of the business and technical organization of the bidder available for the contemplated work, including financial resources, building experience, materials proposed to be used, etc. The United States expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources or building experience compared with the project bid upon, or materials proposed to be used, justify such rejection. The successful bidder will be required to furnish a performance bond of 50% of the contract price. Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (214)

U. S. Government

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., March 20, 1931.—Sealed bids in duplicate subject to the conditions contained herein, will be publicly opened in this office at 3 p.m., April 17, 1931, for furnishing the materials and performing the work required for installing a complete elevator plant in the U. S. court house, extension and remodeling at Portland, Maine. All prospective bidders are hereby notified that, prior to the award of the contract, the right is reserved by the supervising architect to require any or all bidders to submit a statement of facts as to qualifications to furnish Elevators in strict accordance with the specifications, in detail of the business and technical organization of the bidder available for the contemplated work, including financial resources and building experience, material proposed to be used, etc. The United States expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources, or building experience compared with the project bid upon or materials proposed to be used, justify such rejection. The successful bidder will be required to furnish a performance bond of 50% of the contract price. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931 (Public No. 798). Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (211)

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., March 16, 1931.—Sealed bids in duplicate, subject to the conditions contained herein, will be publicly opened in this office at 3 p.m., April 13, 1931, for furnishing the materials and performing the work required for installing one freight elevator in the U. S. post office, etc., at Staten Island, N. Y. The successful bidder will be required to furnish a performance bond of 50% of the contract price. Drawings and specifications may be obtained from this office. JAS. A. WETMORE, Acting Supervising Architect. (215)

MOTOR BARGAINS

Variable Speed—230 Volt—D. C.

1—200-hp. Allis-Chalmers Interpole, 500/1000.
1—150-hp. Westgh. SK-201, 400/800 r.p.m.
1—100/125-hp. Crocker-Wheeler, CMC-101H, 600/1200 r.p.m.
1—100-hp. Westgh. SK-200, 250/700.
2—100-hp. Westgh. SK, 300/1200.
1—75/100-hp. Westgh. SK-210, 200/600.
1—75/100-hp. Crocker-Wheeler, CMC, 500/1000.
2—50-hp Westgh. SK-190, 225/450.
2—35/45-hp. Gen. Elec. RLC-203, 500/1500.
1—25/30-hp. Electro Dyn. 20-8, 400/1200.
3—20/25-hp Gen. Elec. RF-12, 500/1500.
5—15/20-hp. Westgh. SK-110 L, 500/1500.
4—10/14-hp. Gen. Elec. RLC-116, 400/1600.
12—10-hp. Westgh. SK-90, 500/1500.
2—7½/10-hp. G. E. NEW, RF-10, 400/1200.

See last week's listing

BELYEA COMPANY INC. MOTORS GENERATORS ELECTRICAL EQUIPMENT

Motors—Generators—Transformers and Other Electrical Equipment

Belyea Co., Inc. 151 W. 18th St. New York City

REBUILT—GUARANTEED

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT
807 Williams St. NorthBergen, N. J.

Telephones: Palisade 2600-2601

MOTOR GENERATOR SETS

1—500 kw., 250 v. Westinghouse Synchronous motor Generator Set
1—300 kw., 125 v., 3-wire, 3-unit, Ridgeway.
1—250 kw., 230 v., 3 ph., 60 cy., 2300-4600 v. Synchronous Motor Generator set.
1—200 kw., 230 v., 3 ph., 60 cy., 2300-4100 v Synchronous Motor Generator set.
1—150 kw., 600 r.p.m., 250 v., Gen., 3 ph., 60 cy., 220-440 v., G. E. Synchronous motor.
1—125 kw., 250 v. Westinghouse Synchronous Gen, Motor Set, 3 ph., 60 cy., 230-2200 v.
1—100 kw., 125 v., D. C. 220-440 A.C. G.E. Synchronous Motor Generator Set, 220-440 v
1—100 kw., 250 v. Gen., 900 r.p.m., 2200 Synchronous Motor

TURBINES

1—75 kva., 3 ph., 60 cy. Westinghouse Geared Non-Condensing Turbine.

TRANSFORMERS

1—1500/3000 kva. G. E. combined oil and water cooled 3 ph., 60 cy., 11000-22000-2300 v.
3—500 kva. G. E. 13000/26000—220/440.

A. C. GENERATORS

No.	Kw.	R.p.m.	Volts	Ph.	Type
1	400	900	2300/4000	3	Westg.
1	350	600	440	3	Westg.
2	125	900	2300	3	Cr.-Wh.
2	100	900	230-2300	3	G.E.
1	75	600	220	3	Westg.
1	75	900	2300	3	G.E.
1	50	1200	220-440-2300	3	G.E.

MOTORS—3 Phase, 60 Cycle

No.	Hp.	R.p.m.	Volts	Type
1	500	900	440/4000	(Westg. Syn. Con.)
1	500	900	440	G.E. syn.
1	350	900	2200/4000	Wh. syn.
2	300	600	445-2300	G.E. syn.
1	250	600	2200/4000	G.E. syn.
1	250	600	220-440	Westg. syn.
1	250	600	440-2200	G.E. syn.
3	200	514	4150-2300	G.E. syn.
2	175	3 ph.	60 cy.	2300 volts, G.E.
4	150	1200	220-440	Westg. rg.
1	150	900	2300	G.E. syn.
2	150	514	2200	Westg. sl.rg.
1	150	1800	2200	Westg. sq.cg. mtr.
1	100	900	440-2200	G.E. sq. cg.
1	100	900	220-440-220	Westg. sq. cg.

D.C. Generators

No.	Kw.	R.p.m.	Volts	Type
1	200	900	250	G.E.
1	200	600	250	G.E.
1	200	525	250	G.E.
2	150	1200	250	Cr.-Wheeler
1	150	600	250	G.E.
2	150	1200	250	Westg., new
1	100	720	250	G.E.
1	75	450	250	Dieh l

(Smaller Sizes on Request)

D.C. MOTORS—230 VOLT

No.	Hp.	R.p.m.	Type
1	250	550	G.E.
2	200	1150	Cr.-Wheeler
1	150	600	G.E.
3	150	850	Westg. SK, new
1	150	1100	Westg. SK.
1	125	550	Cr.-Wheeler
1	100	625	Westg. Type S

(Smaller Sizes on Request)

D.C. MOTORS—125 VOLT

No.	Hp	R.p.m.	Type
1	125	575	G.E.
1	100	600	G.E.
1	80	600	G.E.

SLIP-RING MOTORS, 3 PH., 60 CY.

Hp.	Volts	Make	Speed
220	220–440	G. E.	450
200	440–220	G. E.	600
154	2200–440–220	G. E.	514
150	220–440	G. E.	720
150	220–440	Westghse.	1200
150	220–440–550	G. E.	600
100	550	Westghse.	900
100	2200	Westghse	900
100	550	G. E.	720
100	440–220	G. E.	720
100	440–220	G. E.	900

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

325	2200–440	G. E.	200
300	440	G. E.	225
240	2200–440	G. E.	720
150	2300–4000	G. E.	900
110	2200–550	G. E.	900
80	2200–440–220	G. E.	1200
60	440–220	Westghse.	1200

MOTOR-GENERATOR SETS AND ROTARY CONVERTERS

1—165-kw., 125-250-v., 6-ph., 60-cy., 1200-r.p.m., G.E. with 2300-4000-v., 3-ph. transformer.
1—100-kw., 250-v., 3-ph., 60-cy., 1200-r.p.m Westghse. with 2300-v. transformer.
2—50-kw., 125-v., 1200-r.p.m., G. E., R. C., connected to KT, 2200-440-220-v., 60-cy., squirrel cage motors.

A. C. GENERATORS

1—250-kva., 200-r.p.m., 2200-440-v., G. E.
1—225-kva., 600-r.p.m., 240-480-v., G. E
1—187-kva., 720-r.p.m., 2200-440-220-v., G. E.
1—120-kva., 900-r.p.m., 2300-4000-v., G. E.
1—112 ½-kva., 900-r.p.m., 2200-240-480-v., G. E.
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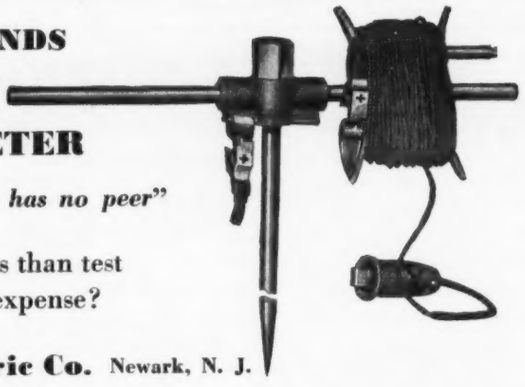

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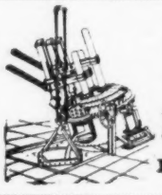

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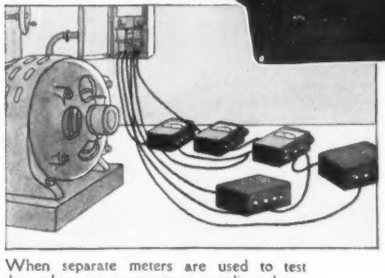

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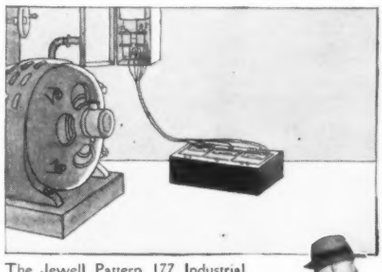

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